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Endocrine disruptors in cosmetic products: effect on the microbiota

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Abstract

The objective of this study was to identify endocrine disruptors in cosmetic products and assess the risk of exposure to the health of users. To achieve this, a questionnaire administered in establishments selling or using cosmetic products: Boutiques, hair salons, Kolwezi, and Lubumbashi; in favor of a cross-sectional descriptive study . We received 1223 replies which identified a noted presence of . resorcinol and moderate and potential sensitizing dyes were the most present, then phenoxyethanol and, followed by sodium lauryl sulfate, ammonium lauryl sulfate, ethylhexyl methoxycinnamate, BHA (Beta Hydroxy acid, octocrylene, salicylic acid, the consequences of which on health are without precedent, ranging from perfumes, foundations, wet wipes... recognized the local effects of allergenic types and a big impact on the intestinal microbiota.

Keywords: Disruptor, Endocrine, Microbiota

Introduction

The human body is negatively affected by environmental pollutants such as particulate matter, diesel, and nicotine smoke [1]. Contact with these chemicals can occur through air, food, skin, and water[2]. The skin is the largest and outermost organ of the human body. As such, the skin represents the major protective barrier between the internal and external environment and protects the body from environmental attacks. Additionally, the skin is important for regulating body temperature and water loss and participates in certain immune responses[3]. Indeed, the skin is the very sensitive channel of exposure to environmental pollutants. Several inflammatory skin diseases have been attributed to exposure to pollutants[4]. These chemicals are associated with a wide range of health problems. They are present in many everyday products, including certain cosmetics, food and drink packaging, toys, carpets, and pesticides[5]. These are chemicals coming from different sources in daily life are prevalent; one such source is the wide range of products listed under the heading "cosmetics", including the various types of popular and widely advertised sunscreens. Skin care practices are essential for maintaining and maintaining healthy skin[6]. These products can be used daily as deodorants, facial moisturizers, or creams[7]

Advances in the cosmetic industry and the emergence of many manufactured products in the last century have resulted in an increase in the consumption of PCPs, leading to excessive exposure of the general population to a wide variety of chemicals that may have adverse effects on health. [8,9]. The presence of these compounds in PCPs can cause negative health effects, including allergies, endocrine disruption, birth defects, neurotoxicity, or cancers [10]. The negative impact of these harmful chemicals in cosmetics and PCPs is not limited to humans, as they can also affect the environment and animals[11,12]. This health risk and its role in the degradation of homeostasis are current concerns. The endocrine-immune-neural axis disruption pathways of these chemicals are being proven. Despite revelations about the cause and effect link, many vulnerable populations are unaware of and are not motivated to avoid these “slow poisons”. Therefore, researchers need to further validate the toxicity of chemical compounds and raise awareness of health risks.

To assess the health risks of users and determine the risk of exposure to endocrine disrupting compounds related to PCP consumption, important predictors such as the co-use pattern of these products should be available which we have conducted this study.

Objective

In this work, we describe the different chemical components present in cosmetic products and how they contribute to the disruption of users' health. In addition, we will demonstrate the interaction between exposure to endocrine disruptors and the balance of the microbiota.

Methods

Study sites.

The cities of Lubumbashi and Kolwezi in the provinces of Haut Katanga and Lualaba in DR Congo served as the site for our study. Establishments selling or using cosmetic products: Boutiques, hair salons, hair care salons were concerned in this study

Questionnaire and survey procedure.

The survey questionnaire included questions identifying endocrine disruptors in cosmetic products. It was designed to last 10 to 15 minutes and included a mix of closed and open-ended questions. The questionnaire was pretested to assess its length and clarity.

Participants were informed that their participation was voluntary and of their freedom to stop the interview at any time or refuse to answer certain questions.

The investigation team divided into two groups to conduct the investigation. One group conducted the interview in French with those who spoke the language well. For those who could not communicate in French, a second group conducted the interview through a translator fluent in Swahili, the main language spoken locally. Responses were collected on laptops using the questionnaire on google form.

Design

This is a cross-sectional study among residents of the city of Lubumbashi on waste management in food chains and risk of transmission of zoonotic diseases. A total of 1223 responses reached us, extracted using Office Excel 2013 then imported and analyzed using Epi info 7.3. The results are presented in table form.

Results and discussion

Table 1

	Deodorants	Scent	Powder	Lotion	Oils	Facial care products	Face powder	Total
ETHYLHEXYL METHOXYCINNAMATE	0	4	0	0	0	6	1	10
TRICLOSAN	0	1	0	0	0	0	1	2
BENZOPHENONE-1, BENZOPHENONE-3	0	0	0	0	0	0	2	2
OCTOCRYLENE	0	2	0	0	0	0	3	5
CYCLOPENTASILOXANE, CYCLOTETRASILOXANE, CYCLOMETHICONE	1	1	0	0	0	0	0	2
SALICYLIC ACID or BHA (Beta Hydroxy acid)	1	2	0	0	0	0	2	5
BUTYLPHENYL METHYLPROPIONAL	1	2	0	0	0	0	0	3
BHT	0	0	1	0	0	1	1	3
METHYLISOTHIAZOLINONE (MIT), METHYLCHLOROISOTHIAZOLINONE (MCIT)	0	2	1	0	0	0	0	3
RESORCINOL	0	4	1	0	0	0	2	7
EXTREME AND STRONG SENSITIZING DYES	0	1	0	0	0	0	0	1
MODERATE AND POTENTIAL SENSITIZING DYES	0	2	1	0	0	0	1	4
PHENOXYETHANOL	1	3	2	0	0	0	0	6
SODIUM LAURYL SULFATE, AMMONIUM LAURYL SULFATE	1	2	1	0	2	0	0	5
TITANIUM DIOXIDE	1	1	0	0	0	0	0	2
MINERAL OILS AND SYNTHETIC HYDROCARBONS	1	1	0	0	0	0	0	2
Total	5	28	8	0	3	7	13	

From this table, it should be noted that perfumes contain more endocrine disruptors, followed by foundations, then powders and deodorants. resorcinol and moderate and potential sensitizing dyes were the most present, then phenoxyethanol and, followed by sodium lauryl sulfate, ammonium lauryl sulfate, ethylhexyl methoxycinnamate, BHA(Beta Hydroxy acid, octocrylene, salicylic acid and subsequently butylphenyl methylpropional and BHT, finally to the least extent, titanium dioxide, phenoxyethanol,

Table 2

	Wet wipe	Lipstick	Varnish	Glue	Total
ETHYLHEXYL METHOXYCINNAMATE	1	1	0	0	2
TRICLOSAN	1	0	0	0	1
BENZOPHENONE-1, BENZOPHENONE-3	1	0	0	0	1
OCTOCRYLENE	1	0	0	0	1
HOMOSALATE	1	0	56	0	1
CYCLOPENTASILOXANE, CYCLOTETRASILOXANE, CYCLOMETHICONE	1	0	0	0	1
SALICYLIC ACID	1	1	0	0	2
BUTYLPHENYL METHYLPROPIONAL	0	1	0	0	1
METHYLISOTHIAZOLINONE (MIT), METHYLCHLOROISOTHIAZOLINONE (MCIT)	1	1	0	0	2
RESORCINOL	0	1	0	0	1
MODERATE AND POTENTIAL SENSITIZING DYES	1	1	2	0	3
PHENOXYETHANOL	1	1	0	0	2
SODIUM LAURYL SULFATE, AMMONIUM LAURYL SULFATE	0	1	0	0	1
TITANIUM DIOXIDE	2	0	0	0	2
MINERAL OILS AND SYNTHETIC HYDROCARBONS	0	1	0	0	1
Total	13	10	2	0	

Endocrine disruptors were more present in wet wipes and in lipsticks and a little in varnishes. Moderate and potential sensitizing dyes were the most present, then phenoxyethanol, ethylhexyl methoxycinnamate, BHA (Beta Hydroxy acid, salicylic acid, titanium dioxide and methylisothiazolinone (MIT).methylisothiazolinone (MIT), are present.

In perfumes, we identified a decreasing presence of Resorcinol, ethylhexyl methoxycinnamates, then phenoxyethanol, followed by octorylene, the moderate and potential sensitizing dyes.

Resorcinol, as a chemical entity of biological interest; also called resorcinol, is a benzene diol or dihydroxybenzene or diphenol, isomer of hydroquinone. is used as an antiseptic and disinfectant in topical pharmaceutical products in the treatment of skin disorders and infections such as acne, seborrheic dermatitis, eczema, psoriasis, corns, calluses, and warts. It exerts keratolytic activity. Resorcinol works by helping to remove hard, flaky, or rough skin. Although primarily indicated for topical use, resorcinol also has well-documented antithyroid activity that is not generally relied upon for any formal therapeutic indication[14]. and according to LOTUS or the natural product occurrence database, it is 1,3-Benzenediol, a flavoring ingredient [15].

Resorcinol could destroy rough, hardened, or flaky skin. In its topical form, it is also used to treat eczema, acne,

psoriasis, corns, seborrhea, calluses, warts and several other skin disorders.[16] Antibacterial and antifungal activities can result from protein precipitation. However, keratolytic activity may contribute to the antifungal effect, as removal of the stratum corneum suppresses fungal growth. Absorption: Resorcinol can be absorbed through ulcerated surfaces or through the skin.[17] .It is a perfuming agent, its role is to give a scent to the product and/or to provide an odor or taste, creating a pleasant odor and/or masking a bad odor.

Resorcinol acts as an endocrine disruptor of thyroid function and induces severe hypothyroidism[18]. It affects thyroid function by inhibiting thyroxine peroxidase. It may also impact iodine absorption [19].

Other than resorcinol, in cosmetic products, we have also identified phenoxyethanol is a preservative used in certain cosmetics to preserve the quality of products and guarantee consumer safety by preventing the proliferation of microbes.

Fragrant compounds share configurational similarity with carcinogenic environmental hydrocarbons and cause expression of the cytochrome group aromatase monooxygenase enzyme. This enzyme aromatizes androgens to form estrogens and ethylhexyl methoxycinnamate, is a stabilizing agent; it improves the ingredients or the stability of the formulation and the shelf life, it is UV absorbent: Protects the cosmetic product against the effects of UV light and UV filter: Allows certain UV rays to be filtered to protect the skin or hair harmful effects of these rays. It is present in men's and women's eau de toilette and perfume boxes at different concentrations; it causes a disruption of estrogen and thyroid function. Indeed, studies have already reported that the methoxycinnamate can penetrate through the epidermis and dermis, spread into the systemic circulation, and can have a systemic action on the body, due to its relatively low molecular weight and lipophilic character [20]. Therefore, methoxycinnamate has been detected in human body fluids such as urine and blood after topical application [21]. It has been reported that methoxycinnamate induced acute toxicities, and many studies, both in vivo and in vitro, revealed multiple endocrine disrupting effects on the estrogen receptor (ER), the androgen receptor (AR), the receptor of progesterone (PR) and the hypothalamus. pituitary-thyroid axis (HPT) [22,23]. cataloged and reported as HPT function deregulators, especially when exposed during early developmental stages [24]. These actions can directly affect the gland and/or corresponding regulatory centers, such as the hypothalamus and pituitary gland, affecting the levels of thyrotropin releasing hormone (TRH) and/or thyroid-stimulating hormone (TSH), which are directly linked to the synthesis of thyroid hormones. Most studies have focused on the estrogenic and anti-androgenic effects of methoxycinnamate in wild and laboratory animals [25-27]; however, only a few studies have focused on the influence of methoxycinnamate on HPT function [28–30].

Also present in wet wipes used to wipe and change diapers for toddlers,

Methoxycinnamate can penetrate through the epidermis and dermis, spread into the systemic circulation, and may have systemic action on the body, due to its relatively low molecular weight and lipophilic nature (6). Therefore, OMC has been detected in human body fluids such as urine and blood after topical application [31].

Octocrylene or octocrilene is an organic ultraviolet (UV) filter that mainly absorbs UVB radiation and short UVA wavelengths. It is used in various cosmetic products either to provide appropriate sun protection factor in sunscreen products or to protect cosmetic formulations from UV rays. There is no doubt that UV filters are beneficial ingredients in cosmetics since they protect against skin cancer, but octocrylene has recently been incriminated for potentially inducing adverse effects on the endocrine system in addition to having a allergic potential and/or photoallergic[32].

Salicylic acid (SA) has long been used safely as an ingredient in topical cosmetic products. Salicylic acid can penetrate deep into your skin to do its job. This quality is precisely what makes it such a powerful ingredient for targeting acne, especially blackheads and whiteheads. Once it penetrates the skin, salicylic acid "dissolves pore-clogging skin debris, acts as an anti-inflammatory, and also helps red, inflamed pimples and pustules disappear more quickly.[33]

In addition to these main endocrine disruptors, we note that the most important allergens causing contact allergy of the scalp are found in bleaching agents and dyes, shampoos and conditioners, these are moderate sensitizing dyes and potential or even extreme and strong sensitizing dyes, sodium or ammonium lauryl sulfate, titanium

dioxide…capable of causing a contact allergy represents an important differential diagnosis compared to other skin diseases of the scalp. The latter being particularly resistant to contact dermatitis, allergens applied to this area often cause dermatitis of the eyelids, ears and neck. Nevertheless, strong allergens such as paraphenylendiamine can also cause serious scalp reactions [36].

We will not end this discussion without addressing the aspects linking endocrine disruptors and the microbiota. The gut microbiota is considered a hidden metabolic organ of the human body influencing human health and diseases [34]. In particular, the gut microbiota regulates a range of physiological functions [35] mainly involved in (i) preservation of the integrity of the intestinal barrier [36], (ii) protection against pathogens [37], (iii) the regulation of host immunity [38,39], (iv) ensuring energy metabolism [40], and (v) modulating immune development [41].

Cosmetics enter the body via various routes and can also cause disruptions in both the skin and intestinal microbiota. It has been shown that the application of cosmetic products can alter the balance of the skin microbiota. This effect can be attributed to many factors, including residual activity of preservatives on the skin [42]. The skin is considered a barrier organ against the entry of foreign physical, chemical and biological aggressions, thus maintaining the internal homeostasis of the human body.[43] It is the site of colonization of various microbes resulting from millions of years of mutual adaptation and functional integration [44], and the human body thus forms a complex and synergistic entity, called a holobiont or meta-organism[45]. . Many factors have been identified that influence system composition, including race, gender, age, lifestyle (e.g., occupation, hygiene, and diet), and environment (e.g., example, climate, geographical location, pollution, UV rays and diet). other radiation) and the use of skin products and medications [46,47] and these factors are linked to factors that influence systemic metabolisms, such as diet, hormone levels, and gut microbiota may also impact significant on local microhabitats of the skin [48]

The interactions between the gastrointestinal microbiota and endocrine disruptors are multiple and interdependent. On the one hand, cosmetics or environmental contaminants modify the composition of gastrointestinal bacteria and/or the metabolic activity which shapes the micro biotype of the host; on the other hand, GM widely metabolizes cosmetic or environmental chemicals, thus modulating their toxicity in the host [49] either through direct or indirect xenobiotic biotransformation through hydrolysis, elimination of the succinate group, dehydroxylation, l acetylation, deacetylation, proteolysis, denitration, deconjugation or opening of the thiazole ring [50] or by altering microbial diversity and thus inducing dysbiosis [51]. Or even by interference with the enzymatic activity of GMOs. the most important of these enzymes, β-glycosidase catalyzes the hydrolysis of plant polyphenol glycosides and β-glucuronidase (GUSB) catalyzes the removal of glucuronic acid from glucuronidases produced by the liver [52] . Therefore, EDCs, by disrupting GMOs, can alter host physiological processes mediated by these enzymes.

endocrine disruptors in cosmetic products and in the environment can enter the body through the skin, mucous membranes including the lower respiratory tract, and have direct and indirect harmful effects on different organs and tissues. They also have an impact not only on the skin microbiota, but also on the intestinal microbiota with all the resulting consequences on reproduction, immunity, diabetes and associated disorders and mental illnesses. endocrine disruptors are among the environmental factors causing dysbiosis of the intestinal microbiota [53], indicating a link between the two actors. Numerous reports provide evidence of an association of neurodegenerative and even neuropsychiatric diseases with dysbiosis of the gut microbiota [54,55] in addition to impaired spermatogenesis and abnormal sperm production, including disruption of steroidogenesis. testicular in Leydig cells [56,57] and polycystic ovarian syndrome (PCOS), one of the most common female reproductive disorders, is characterized, among other things, by dysregulation of steroid hormones leading to hyperandrogenism

In addition, PEs affect the development, differentiation and functions of various immune cells, lymphocytes, monocytes, dendritic cells, neutrophils, mast cells, eosinophils, and natural killers [58]. The commensal gut microbiota regulates the maturation of the mucosal immune system, while the pathogenic microbiome causes immune dysfunction, leading to the development of diseases.

The gut microbiota is capable of synthesizing and metabolizing steroid hormones and, as such, contributes to their circulating levels and indirectly affects brain development and function [59]. Less information is available regarding the role of the microbiota in thyroid hormone biosynthesis and metabolism [60].

Conclusion

Endocrine disruptors have become ubiquitous components in personal care and household cleaning products. Overwhelming trends in consumerism have led to excessive use of these chemicals. This unhealthy lifestyle laden with endocrine disruptors has been observed to parallel unprecedented rates of diabetes, cancer, neuronal diseases, teratogenicity, and changes in the microbial population affecting endogenous estrogen metabolism by modulating circulation. enterohepatic of these hormones, with a subsequent impact on the hormonal balance of women and men, the consequences of which affect their fertility due to the important relationship that exists between a healthy intestinal microbiota and the immune system.

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Ethical consideration

Not applicable

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