Detection of Endocrine disruptors in personal care products in Bangladesh

A Study Report By
Environment & Social Development Organization ESDO
In Association with
Wonjin Institute for Occupational and Environmental Health (WIOEH)

ESDO

IPEN
for a toxics-free future

금융산업공익재단
Korea Financial Industry Foundation

Wonjin Institute
for occupational & Environmental Health

Detection of Endocrine disruptors in personal care products in Bangladesh

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The Environment and Social Development Organization, ESDO, is an action research oriented non-profit and non-government organization in Bangladesh. It is an environmental action research group dedicated to a toxic-free, zero-waste planet. This entails fighting pollution and building regenerative solutions in cities through local campaigns, shifts in policy and finance, research and communication initiatives, and movement building. ESDO is working relentessly to ensure biological diversity since its establishment in 1990. It is the pioneer organization that launched the anti-polythene campaign in 1990, which resulted in a complete ban of polythene shopping bags throughout Bangladesh in 2002.

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Executive Summary

Parabens, fluorides, and sodium dichloride, commonly found in cosmetics and personal care items, are raising alarms due to their potential disruption of the endocrine system by mimicking estrogen. This study, conducted by ESDO in partnership with Wonjin Institute for Occupational and Environmental Health (WIOEH), aimed to assess the prevalence of these substances in Bangladeshi personal care products to understand the local landscape and potential risks to consumers. Sustainable Development Goals 3 (Good Health and Well-being), 12 (Responsible Consumption and Production), and 15 (Life on Land). Furthermore, its findings hold significance for the BRS COP, particularly the Stockholm Convention.

ESDO investigated the presence of these endocrine-disrupting chemicals in local toothpaste and handwash product. Thirty samples from various shops in Dhaka were collected and analyzed by WIOEH.

The findings revealed that all tested toothpaste and handwash products contained chemicals surpassing permissible limits. While fluoride, found exclusively in toothpaste, and sodium dichloride were present at high levels in all samples, notably elevated paraben levels were found in 5 out of 22 adult products. One toothpaste contained a worrisome 1423 µg/g of parabens, while two handwashes showed alarming paraben concentrations ranging from 1403 to 1834 µg/g. Additionally, a children's toothpaste contained 659 µg/g methyl paraben and 50.5 µg/g of butyl parabens. Comparisons with samples from seven other countries indicated that Bangladeshi products exhibited the highest concentrations of parabens.Among the toothpaste samples, 86% of the samples had high concentration of fluorides which exceeded the permissible limit and all of the sample contained high level of sodium dichloride.

Bangladesh currently lacks regulation concerning EDCs. This study aims to pioneer research on EDCs in Bangladesh, addressing a significant gap in understanding and regulation. Implementing regulatory measures is imperative, given the substantial adverse effects EDCs can have on both human health and the environment.

Key Words: Parabens, Fluorides, Sodium Dichloride, Endocrine disruption, Toxicology, Health risk, Cosmetics, Health, Environment

1. Background

Group of chemicals widely used as artificial preservatives in cosmetic and body care products since the 1920s. Since cosmetics contain ingredients that can biodegrade, these chemicals are added to prevent and reduce the growth of harmful bacteria and mold, increasing the product's shelf life.[1]

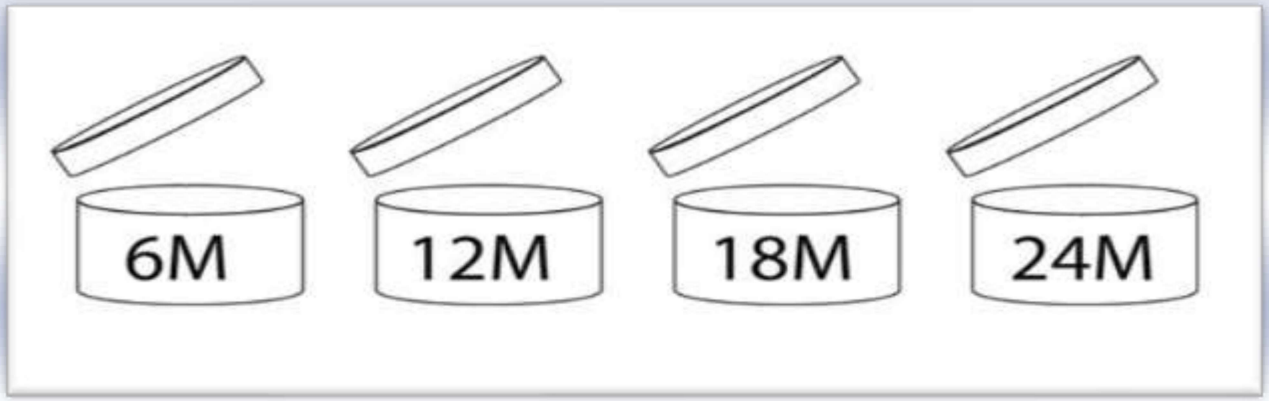

Image: Product shelf-life symbol

Common chemical groups include parabens, fluorides, chlorides, triclosan, propyl glycol, diethanolamine and artificial sweeteners are used in a wide variety of leave-on and rinse-off products, especially those with a high water content, such as shampoos and conditioners, which people use daily. Their antimicrobial properties are most effective against fungi and gram-positive bacteria.[2]

Cosmetics typically contain mixtures of different types of parabens. The most commonly used six types are methyl-, ethyl-, propyl-, isopropyl-, butyl- and isobutylparaben. The so-called shorter-chain parabens, methyl- and ethyl-, are commonly used in combination, whereas butylparaben is often used alone. The longer-chain parabens, propyl- and butyl-, are linked to stronger estrogenic activity. The branched

[1] https://www.ewg.org/what-are-parabens
[2] https://www.mdpi.com/2076-3417/11/5/2307

structure has been shown to increase estrogenic activity as well as sensitization potency.[3]

Paraben	Skin Deep Score	Number of Products
Propylparaben	**7**	**2694**
Isopropylparaben	**8**	**47**
Butylparaben	**7**	**586**
Isobutylparaben	**8**	**285**

Table: Common parabens in cosmetics and skin deep score

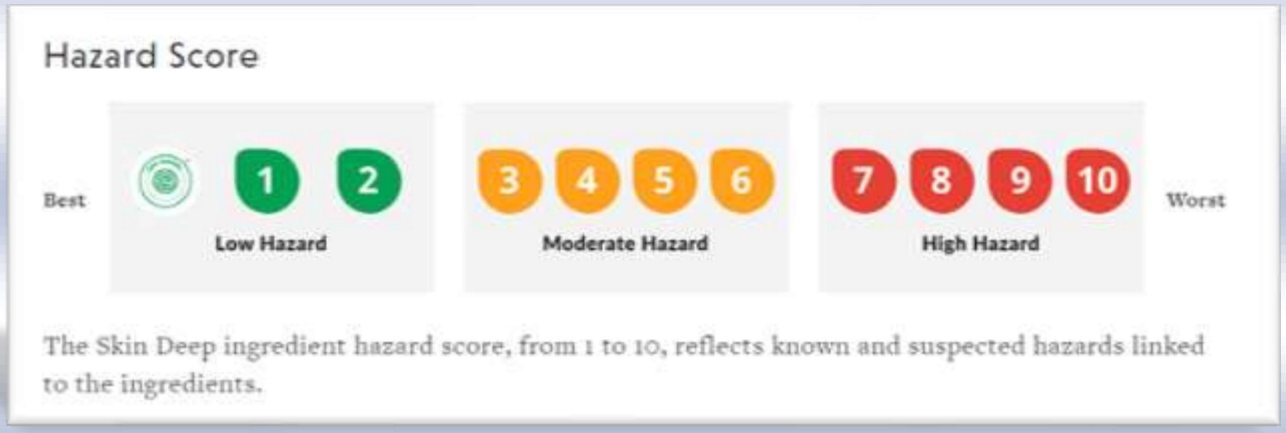

Image: Skin Deep Score

The "Skin Deep" score refers to a rating system used for skincare and cosmetic products. It evaluates the safety and potential health hazards associated with the ingredients in these products. Each ingredient is assessed for its potential to cause allergies, cancer, developmental or reproductive toxicity, and other harmful effects.

The score is usually represented on a scale, with lower scores indicating safer products and higher scores indicating potential risks. However, the specific scoring system can vary depending on the organization or database providing the information.[4]

[3] https://carolyngeorgemd.com/blog/parabens-phthalates/#:~:text=Cosmetics%20typically%20contain%20mixtures%20of,butylparaben%20is%20often%20used%20alone.

[4] https://www.ewg.org/skindeep/learn_more/users-guide/

2. EDC Use in Cosmetics

Chemicals are commonly used in cosmetics and personal care products for several reasons:

Preservation: Chemicals are effective preservatives that help prevent the growth of bacteria, mold, and yeast in cosmetic products. This property extends the shelf life of products, reducing the risk of microbial contamination and ensuring their safety and stability over time.[5]

Product Stability: Chemicals help maintain the integrity and quality of cosmetic formulations by preventing degradation caused by microbial activity or exposure to air, light, and temperature variations. This ensures that the product remains effective and maintains its intended properties throughout its shelf life.[6]

Cost-Effectiveness: Common chemicals such as parabens are relatively inexpensive compared to other preservatives, making them a cost-effective option for manufacturers of cosmetics and personal care products. Their affordability allows for the production of affordable consumer goods, which benefits both manufacturers and consumers.[7]

Wide Compatibility: Chemicals exhibit broad-spectrum antimicrobial activity and are compatible with a wide range of cosmetic ingredients, formulations, and packaging materials. This versatility makes them suitable for use in various types of products, including lotions, creams, shampoos, makeup, and more.[8]

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[5] https://www.fda.gov/cosmetics/cosmetic-ingredients/parabens-cosmetics

[6] https://www.researchgate.net/publication/307856008_PARABENS_PARADOXES_IN_COSMETIC_FORMULATIONS_A_REVIEW

[7] https://www.eabcglobal.com/methylparaben-mp#:~:text=Cost%2Deffective%3A%20Methylparaben%20is%20relatively,%2C%20including%20mass%2Dproduced%20products.

[8] https://www.sciencedirect.com/science/article/pii/S0045653522005124

Despite their effectiveness as preservatives, the use of certain chemicals in cosmetics has raised concerns about their potential health effects, particularly their ability to mimic estrogen and potentially disrupt hormone regulation. As a result, some consumers and manufacturers are seeking alternatives to parabens, leading to the development and use of alternative preservatives in cosmetic formulations.

3. Overview of Parabens

Parabens function as versatile antimicrobial preservatives in various consumer products such as cosmetics, personal care items, pharmaceuticals, and food and beverage processing, aiming to prevent the growth of molds and yeasts. Their popularity stems from several attributes, including chemical stability across a broad range of temperatures and pH levels (4.5 to 7.5), cost-effectiveness, lack of discernible odor or taste, low toxicity, and widespread acceptance globally.[9]

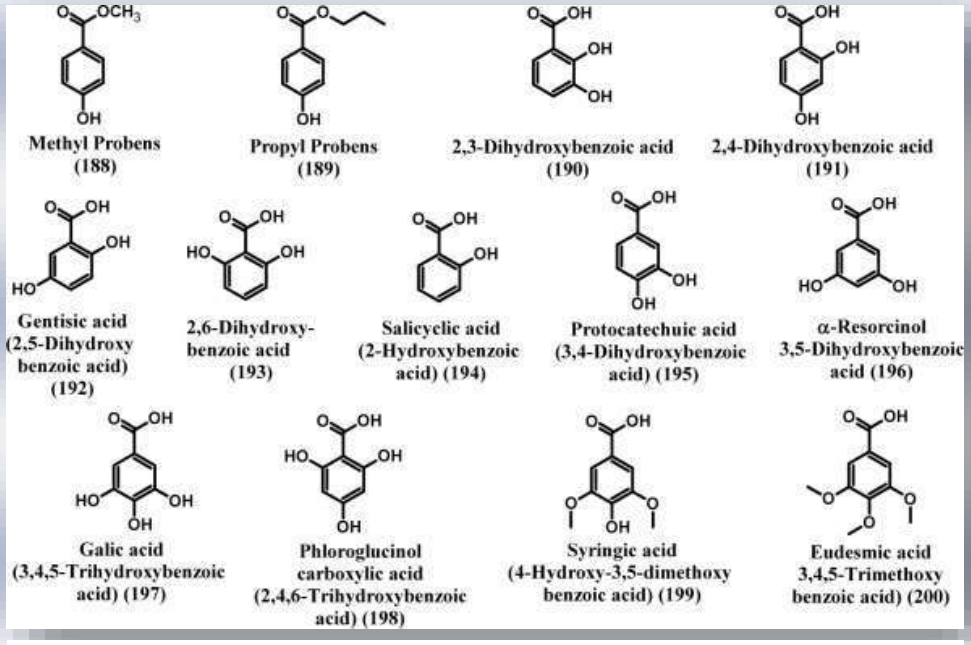


Figure: Paraben Structures

Primarily, parabens possess a chemical structure comprising esters of p-hydroxybenzoic acid (pHBA) with multiple alkyl substituents, defining their composition. These substituents endow each paraben ester with varying solubility and a spectrum of antimicrobial activity. Parabens

[9] https://www.ueno-fc.co.jp/english/pdf/PARABEN2013.pdf

exhibit stability in acidic solutions and under both hot and cold temperatures. However, in alkaline solutions, they undergo hydrolysis to form p-hydroxybenzoic acid and the corresponding alcohol.[10]

The resistance of microbes in aqueous solutions increases with the length of the alkyl chain, and the antibacterial properties are directly proportional to the ester group's chain length. Among parabens, methylparaben and propylparaben are the most commonly used in products such as shampoos, conditioners, lotions, facial cleansers, and scrubs, with women being the predominant consumers of these products. [11]

On the other hand, Concerns about the potential effects of parabens on the endocrine system have arisen due to their ability to mimic the activity of estrogen, a hormone that plays a critical role in various physiological processes. Parabens have been found to bind to estrogen receptors on cells, albeit much less strongly than naturally occurring estrogen.[12]

4. Overview of Fluorides

Fluorides are naturally occurring minerals found in soil, water, and some foods. They are also widely used in various personal care products.[13]

Uses:

- **Toothpaste:** The most common and well-established use of fluoride in personal care is in toothpaste.
- **Mouthwash:** Fluoride-containing mouthwashes offer additional protection against cavities and can help address bad breath.
- **Other products:** Less commonly, fluorides may be found in some **dental gels, rinses, or remineralization treatments**.

[10] https://www.researchgate.net/publication/7904546_Safety_assessment_of_esters_of_p-hydroxybenzoic_acid_Parabens
[11] https://pubmed.ncbi.nlm.nih.gov/35442105/
[12] https://pubmed.ncbi.nlm.nih.gov/16097138/
[13] https://knightstreetdentists.com.au/what-is-fluoride/#:~:text=Benefits%20of%20fluoride%20toothpaste,it%20more%20resistant%20to%20decay.

Safety Concerns[14]:

- **Swallowing:** While the low concentrations in personal care products are generally safe, accidental swallowing by young children can be problematic. Supervision and appropriate toothpaste choices are crucial.
- **Excessive exposure:** Overexposure to fluoride from various sources (water, supplements, toothpaste) can lead to dental fluorosis, which causes white spots on teeth.
- **Other concerns:** Some limited research suggests potential links between fluorides and other health issues, but these remain inconclusive and require further investigation.

5. Overview of Sodium Dichloride

"Sodium dichloride" is more commonly known as table salt, a crystalline mineral essential for life.

Uses: Food seasoning, food preservation, deicing roads, water softening, chemical production (chlorine, sodium hydroxide).

Safety: Generally safe in moderate amounts. Excessive intake can lead to high blood pressure and other health problems.

Properties: White, odorless, soluble in water.

[14] https://www.cdc.gov/fluoridation/faqs/dental_fluorosis/index.htm#:~:text=What%20causes%20dental%20fluorosis%3F,are%20forming%20under%20the%20gums.

6. Endocrine System

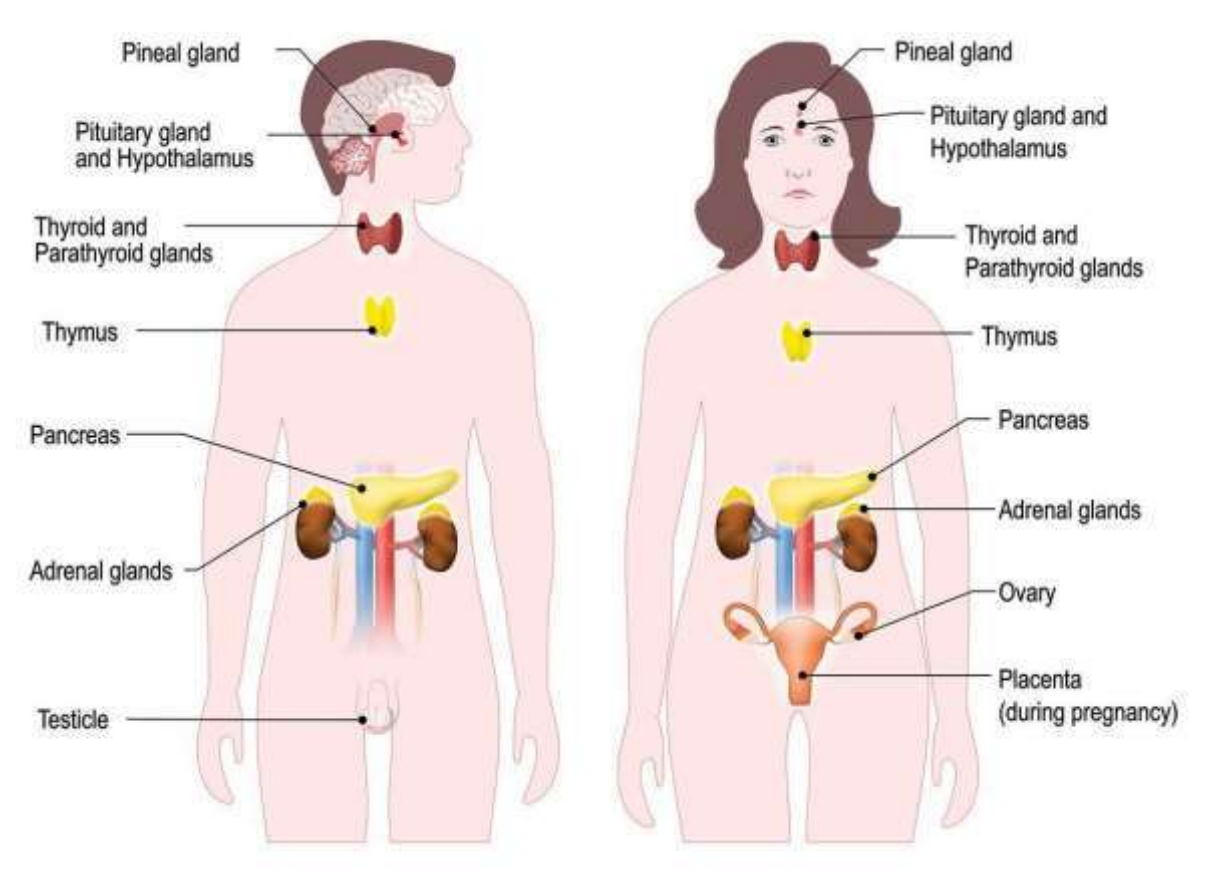


Figure: Endocrine System

The endocrine system is a network of glands and organs in the body that produce hormones to regulate various bodily functions. These hormones are chemical messengers that travel through the bloodstream to target cells or organs, where they exert their effects. Key components of the endocrine system include glands such as the pituitary gland, thyroid gland, adrenal glands, pancreas, ovaries (in females), and testes (in males). Each gland produces specific hormones that play crucial roles in regulating processes like metabolism, growth and development, reproduction, and stress response. For example, the thyroid gland produces hormones that regulate metabolism, the adrenal glands produce hormones involved in the body's response to stress, and the pancreas produces insulin, which regulates blood sugar levels. The endocrine system works in coordination with the nervous system to maintain homeostasis and ensure the proper functioning of the body.[15]

[15] https://kidshealth.org/en/parents/endocrine.html

7. Parts of the Endocrine System

While many parts of the body make hormones, the major glands that make up the endocrine system are the:

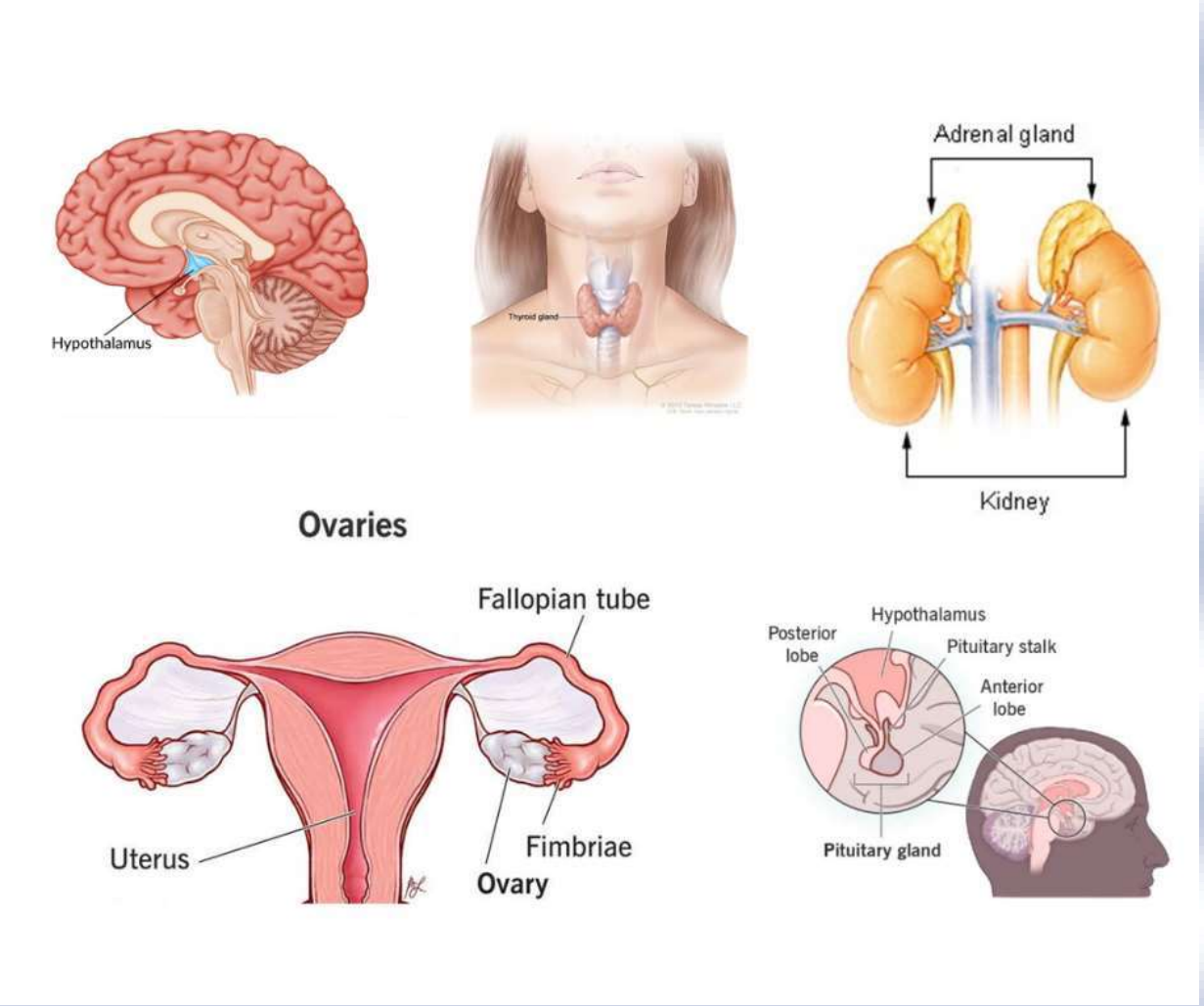


Figure: Parts of Endocrine System

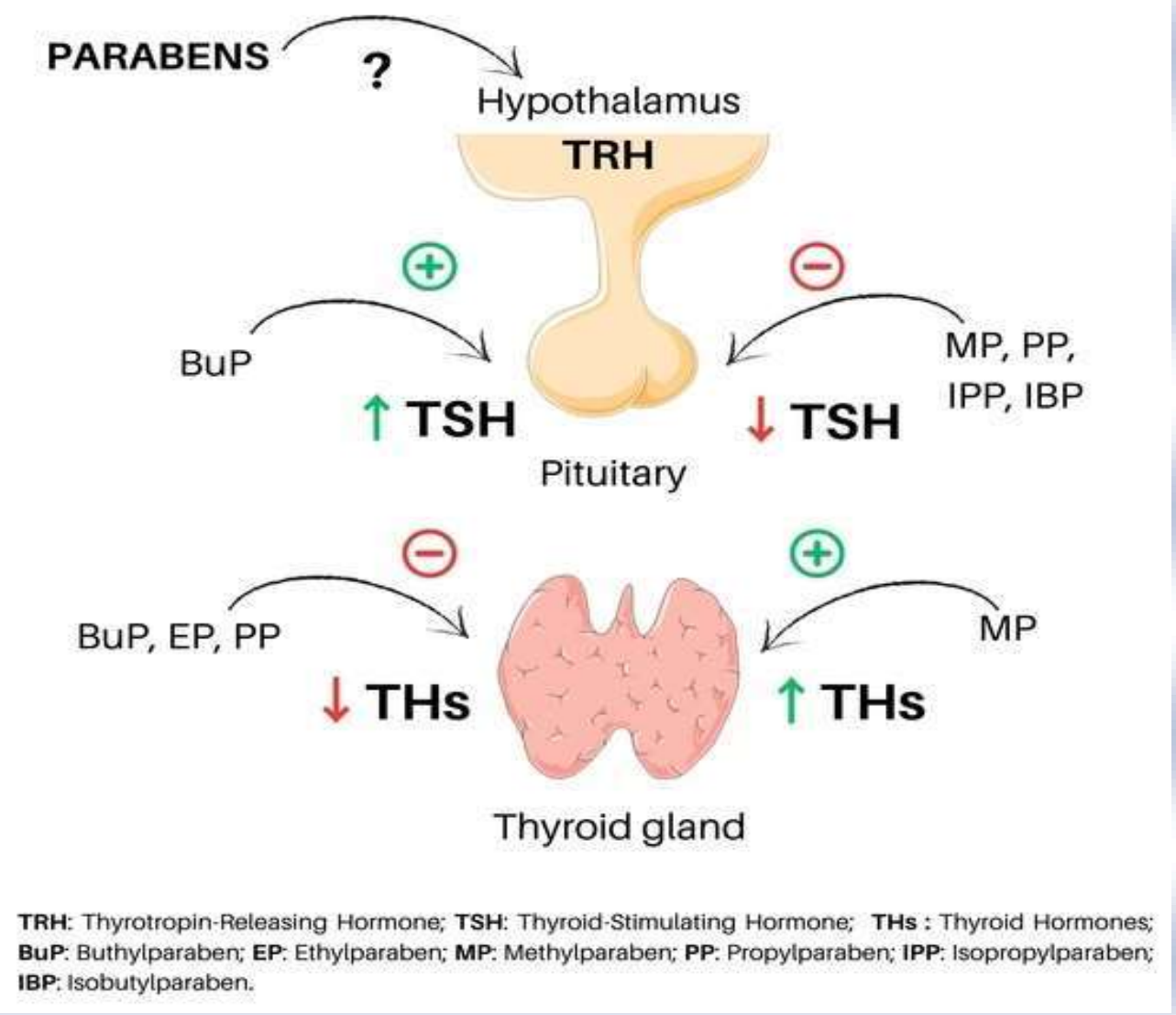
8. Endocrine Disrupting Chemicals

9. Effects on Endocrine System

The potential effects of EDCs on the endocrine system include:

Endocrine Disruption: Parabens may interfere with the normal function of the endocrine system by mimicking or blocking the action of hormones. This disruption could potentially lead to adverse effects on reproductive health, development, and metabolism.[16]

[16]https://www.researchgate.net/publication/305453242_Minireview_Endocrine_Disruptors_Past_Lessons_and_Future_Directions

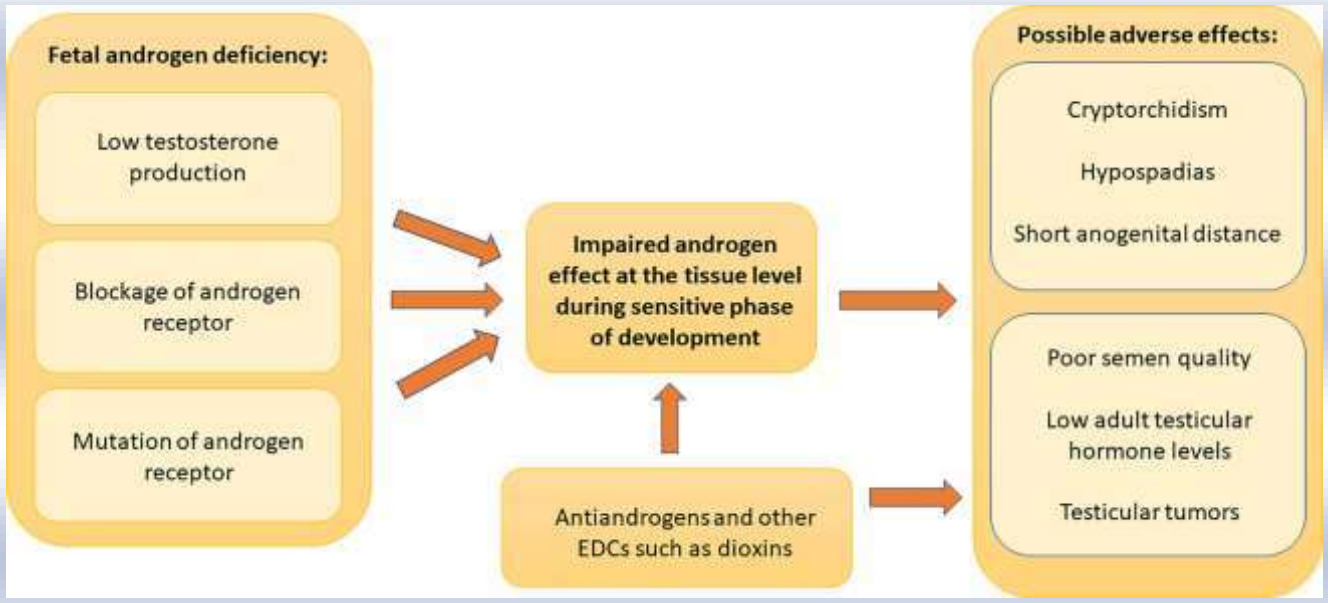


TRH: Thyrotropin-Releasing Hormone; **TSH**: Thyroid-Stimulating Hormone; **THs** : Thyroid Hormones; **BuP**: Buthylparaben; **EP**: Ethylparaben; **MP**: Methylparaben; **PP**: Propylparaben; **IPP**: Isopropylparaben; **IBP**: Isobutylparaben.

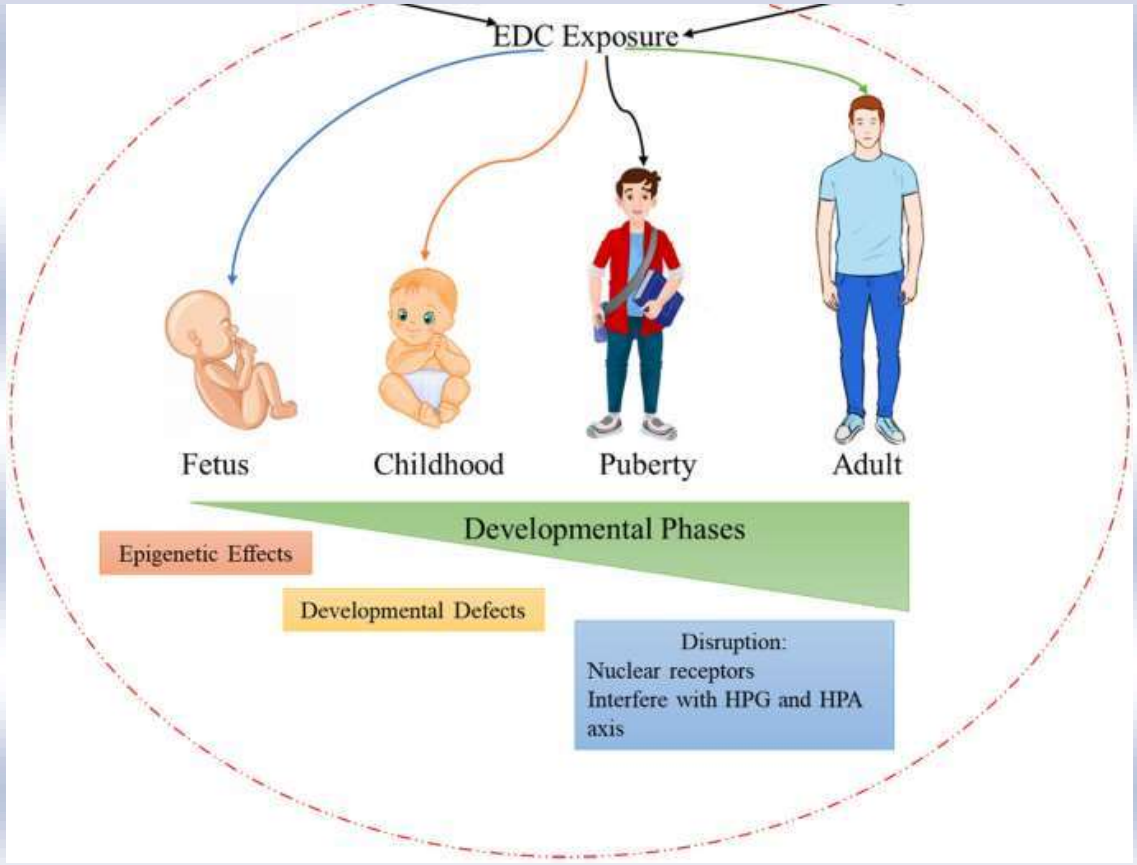
Estrogenic Activity: Parabens have weak estrogenic activity, which means they can activate estrogen receptors in the body. Prolonged exposure to estrogenic compounds has been associated with an increased risk of certain hormone-related cancers, such as breast cancer.[17]

Reproductive Health: Some studies suggest that exposure to parabens may be associated with adverse effects on male and female reproductive health, including disruptions in hormone levels, sperm quality, and menstrual cycle regulation.[18]

[17] https://www.mdpi.com/1660-4601/19/3/1873
[18] https://pubmed.ncbi.nlm.nih.gov/37688867/

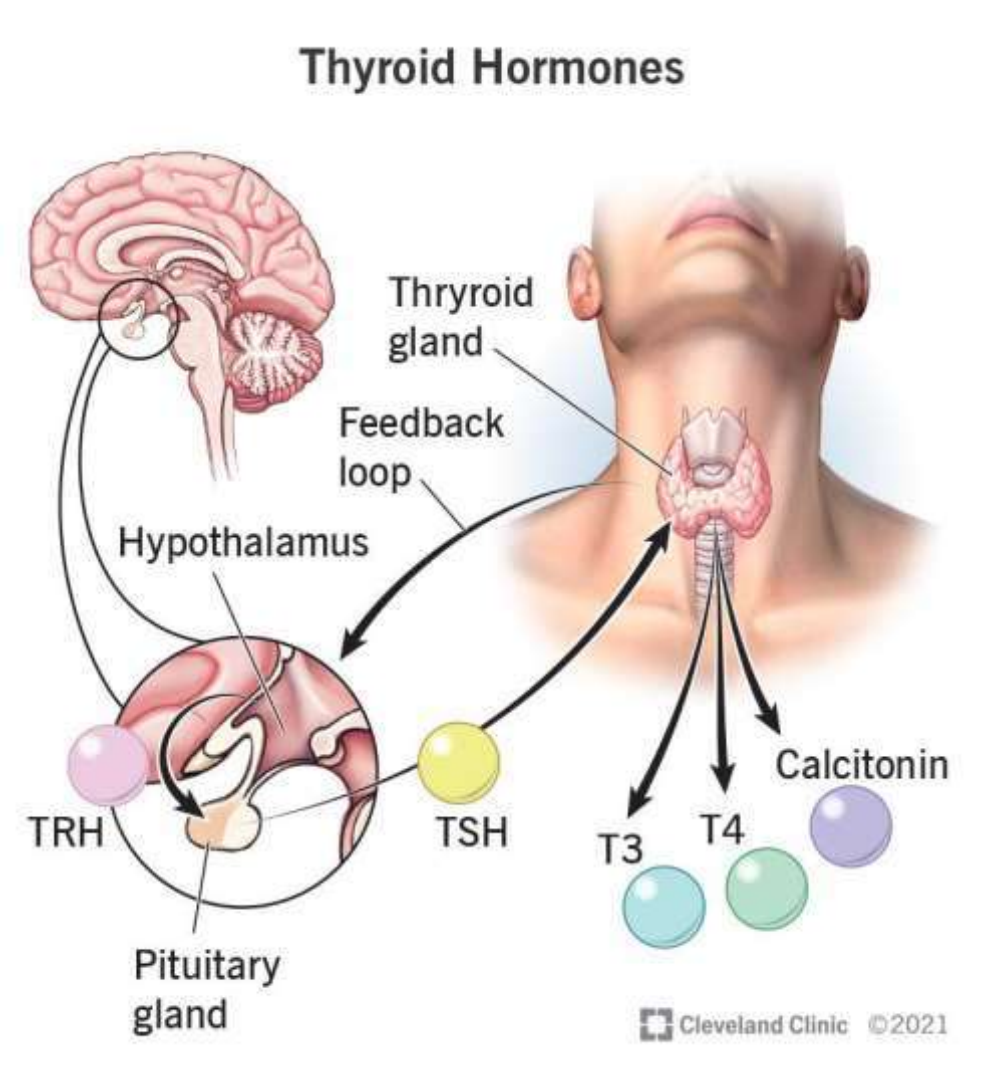


Developmental Effects: There is concern that exposure to parabens during critical periods of fetal development or early childhood may disrupt normal hormone signaling and contribute to developmental abnormalities.[19]



[19] https://link.springer.com/article/10.1007/s12595-021-00414-1

Thyroid Function: While research on this topic is limited, some studies have suggested that parabens may interfere with thyroid function, which plays a crucial role in regulating metabolism, growth, and development.[20]



Recent studies have shown that parabens have potential negative impacts on reproductive health . In the study of Jurewicz et al., they found a relationship between the concentration of parabens in urine and the parameters of ovarian reserve. [21]

[20] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2174406/
[21] https://www.mdpi.com/1422-0067/24/20/15246#:~:text=Experimental%20studies%20have%20shown%20that,in%20hormone%20action%20%5B107%5D.

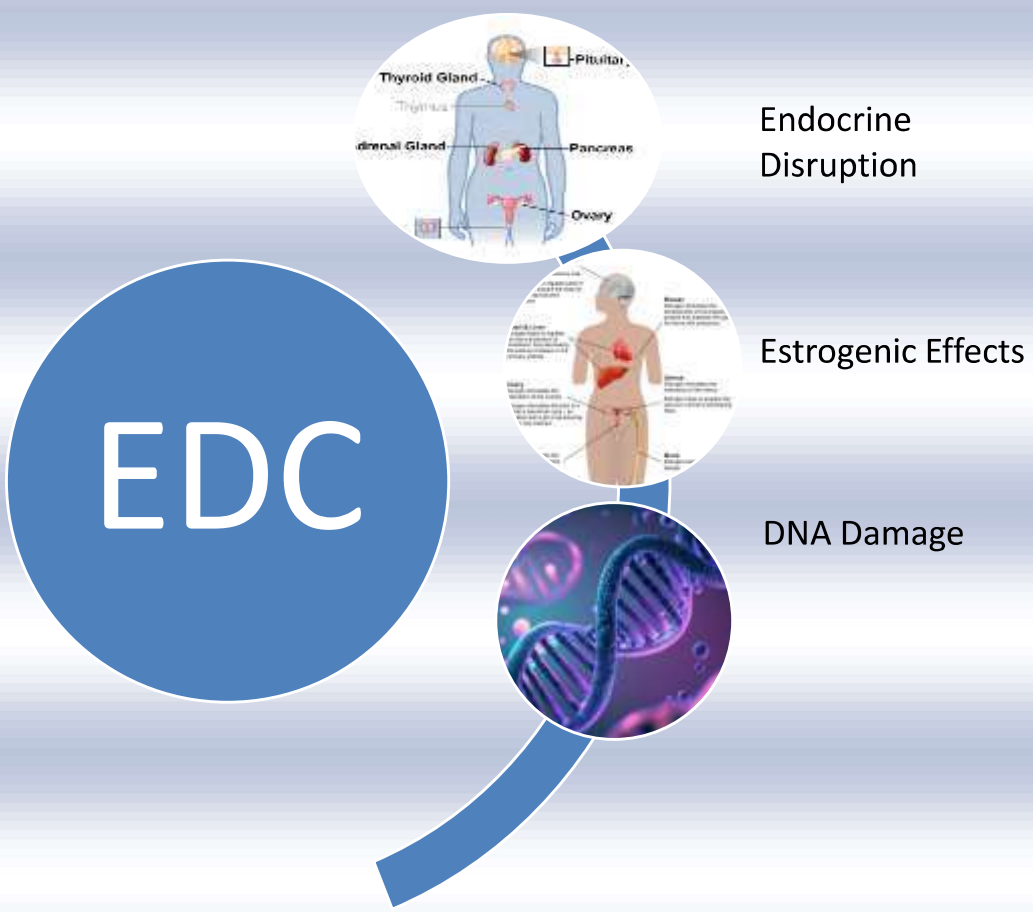


Figure : Overview of Disruption

10. Fluorides Effects

The inclusion of a poison warning on fluoride toothpaste labels is a result of the serious health risks associated with swallowing excessive amounts of fluoride.[22]

Fluoride Toxicity

Excessive consumption of fluoride during early childhood can cause dental fluorosis and skeletal fluorosis, leading to tooth and bone deformities. The absorption of this ingredient can result in lasting tooth discoloration, stomach problems, acute toxicity, skin rashes, and impaired glucose metabolism. Fluoride poisoning often goes undiagnosed or mistreated due to its symptoms resembling other common ailments.

Dental Fluorosis

Too much exposure to fluorides can disrupt the balance of bones (skeletal fluorosis) and affect tooth enamel formation (dental/enamel fluorosis). The seriousness of dental fluorosis also relies on the amount of fluoride and when and for how long the exposure occurred. Prolonged exposure to low levels of fluoride can cause the enamel of the tooth to develop small white streaks or specks. In cases of dental fluorosis that are severe, the tooth shows more pronounced discoloration and brown spots. The enamel can develop a rough or pitted texture, making it hard to clean. Eventually, the permanent spots and stains on the teeth may get darker.

[22] https://www.drbrite.com/blogs/be-natural-health-tips-clean-beauty-care/why-use-fluoride-free-toothpaste

11. Sodium Dichloride Effects

Consuming excessive amounts can lead to various health problems[23].

High blood pressure: Excessive sodium intake is a major risk factor for high blood pressure, which can lead to heart disease, stroke, and kidney problems. The American Heart Association recommends limiting daily sodium intake to 2,300 mg (ideally less than 1,500 mg) for most adults.

Stroke and heart disease: High blood pressure from excessive sodium intake contributes significantly to the risk of these cardiovascular diseases.

Water retention: Sodium draws water into cells, leading to bloating and swelling, especially in people with health conditions like heart failure or kidney disease.

Headaches and migraines: For some individuals, high sodium intake can trigger headaches and migraines.

[23] https://www.who.int/news-room/fact-sheets/detail/salt-reduction#:~:text=The%20primary%20health%20effect%20associated,cardiovascular%20diseases%2C%20gastric%20cancer%2C%20obesity

12. Toxic Ingredients in Toothpaste

Fluoride, while preventing tooth decay, may cause discoloration and potentially more serious health effects, such as neurological and endocrine dysfunction. Research even indicates that fluoride may hinder children's cognitive development. Similarly, triclosan raises concerns about thyroid function, antibiotic resistance, and even skin cancer risk. Sodium lauryl sulfate can irritate

skin and worsen mouth ulcers, while propylene glycol, in large amounts, might harm the nervous system, liver, and heart. Artificial sweeteners like saccharin and aspartame carry potential risks like cancer and impacting gut bacteria, respectively. Diethanolamine and parabens can also disrupt hormonal functions and potentially lead to health issues.

13. Study Objectives

- To find out if there is a label on products
- To confirm any incorrectness with the labels of collected products
- To confirm if any of the products exceeded the standards
- At a preventive level, to identify the use of EDCs (parabens, fluorides and sodium dichloride's) in tooth paste and handwash

14. Methodology

Environment and Social Development Organization-ESDO in Bangladesh, in collaboration with the Wonjin Institute for Occupational and Environmental Health-WIOEH in South Korea, conducted an extensive research study. The report was crafted using data obtained from both primary and secondary sources. Initially, a desk study was undertaken to offer initial findings on the presence of parabens in everyday products and associated regulations. Primary data collection involved two main aspects: (1) collecting samples and (2) analyzing these samples, both of which are detailed in this section. Following the data analysis, visual representations were generated to facilitate meaningful assessments.

15. Sample Collection

The sample collection was performed in July 2023. ESDO team members collected 30 samples of personal care products from different shops in Dhaka, Bangladesh. After the collection of the products, they were kept in plastic wrapping, stored in a zippered storage bag, labeled and sent to the Wojin Institute for Occupational and Environmental Health-WIOEH, South Korea, for analysis.

Products	Brands	Sample Size
Toothpaste	• Sensodine • Pepsodent • Colgate Active salt • Colgate total 12 advanced health • Mediplus ultimate dental care • Baby gel toothpaste, orange flavor • Daily sensitivity protection	14

Handwash	• Dettol cool everyday protection handwash • Savlon ocean blue antiseptic handwash • Lifebuoy vitamin added germ protection • Sepnil natural sanitizing handwash • Dr. Rhazes Gentle foaming handwash • D-Care Antibacterial Handwash	16

16. Sample Analysis

Sample analysis was performed in two phases, (1) identification of labeling, and (2) chemical analysis.

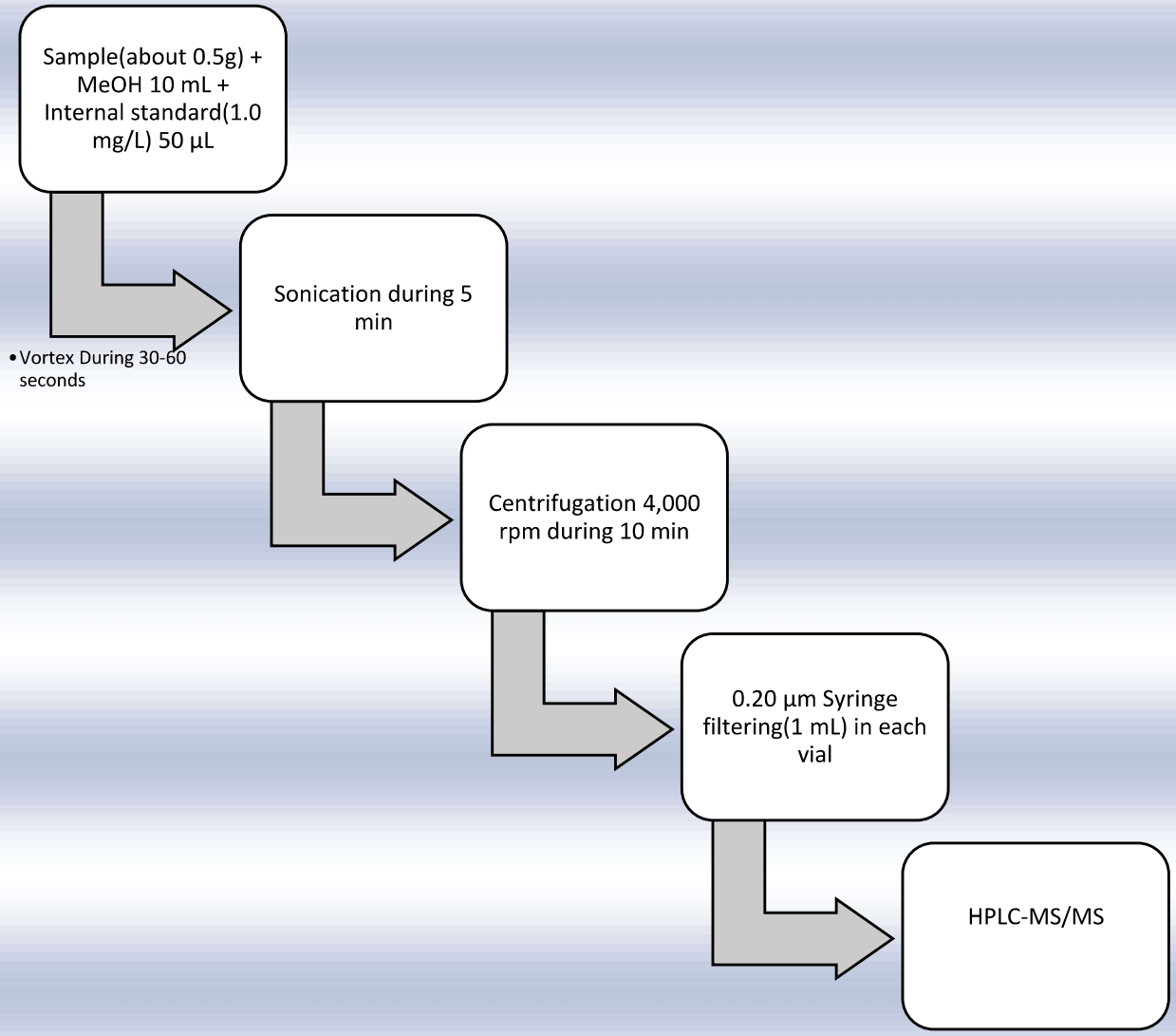
16.1. Identification of labeling

Labeling verification is a crucial step in the quality control process for personal care products. It involves checking the information provided on each packaging to ensure compliance with regulations and to guarantee that consumers have access to accurate details about the product. This includes ingredients, usage instructions, and any necessary warnings. By meticulously examining the labeling on each package, companies can uphold transparency, adhere to safety standards, and ultimately build trust with their customers.
Therefore, labeling was checked from each packaging of the personal care products packaging.

Figure: Sample labeling explanation

16.2. Chemical Analysis

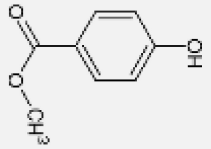
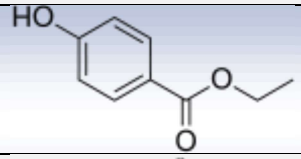
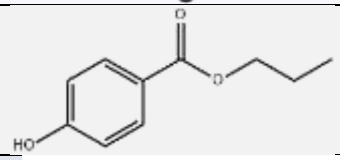
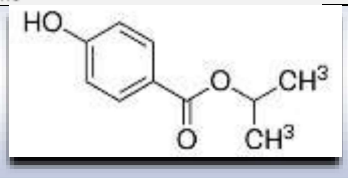
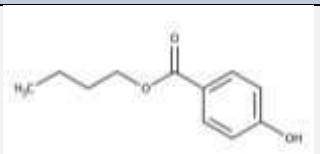
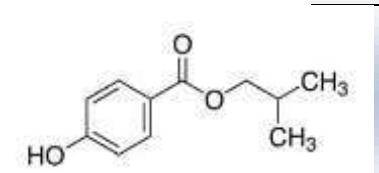
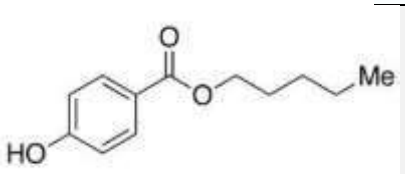
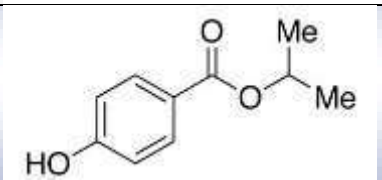
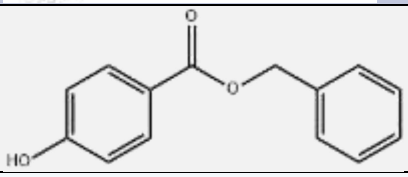
After mixing the sample and methanol, sonicate. Afterwards, centrifuge was performed and the final sample through syringe filtering was analyzed by HPLC-MS/MS to obtain the results.

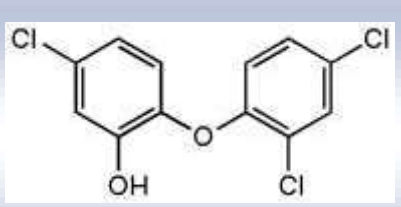
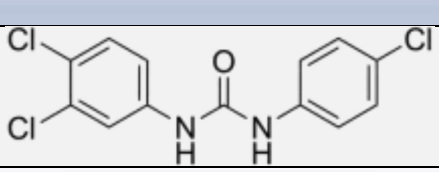
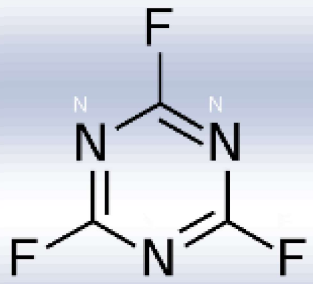
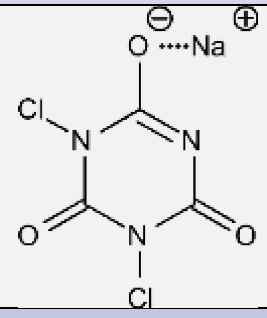


Reference: Kim Bo-young et al., Analysis of preservative content in medicines and personal hygiene and household products, 2016 Korea Food and Drug Safety Evaluation Institute, paraben total exposure assessment and integrated risk assessment technology development, 2018-2019

Figure: Chemical Method

List of Tested compounds:

Compound	Molecular Formula	Structure
Methylparaben	$C_8H_8O_3$	
Ethylparaben	$C_9H_{10}O_3$	
Propylparaben	$C_{10}H_{12}O_3$	
Isopropyl paraben	$C_{10}H_{12}O_3$	
Butylparaben	$C_{11}H_{14}O_3$	
Isobutyl paraben	C11H14O3	
Pentyl paraben	$C_{12}H_{16}O_3$	
Phenyl paraben	$C_{13}H_{10}O_3$	
Benzyl paraben	C14H12O3	

Triclosan	$C_{12}H_7Cl_3O_2$	
Triclocarban	$C_{13}H_9Cl_3N_2O$	
Fluride	F–	
Sodium Dichloride	Cl2Na-	

17. Results

Detection of Labelling

Non-compliance with ingredient labeling was found 13.3% in Bangladesh.

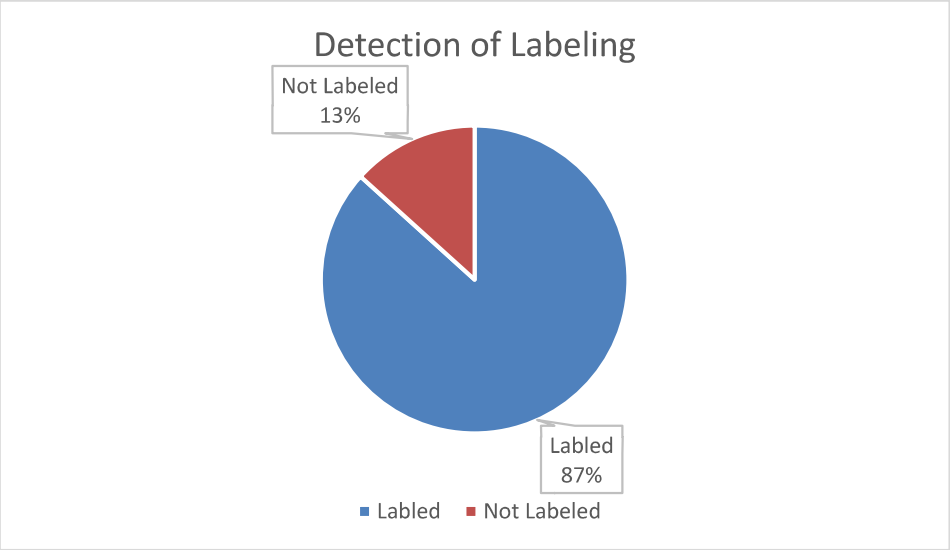


Figure : Detection of Labeling

Among the samples, it was discovered that 13% of them lacked labeling in the personal care products. This lack of labeling could potentially pose challenges for consumers in understanding important information such as ingredients, usage instructions, or safety warnings associated with these products.

Incorrectness with Labelling and Paraben Concentration

Adult Products

# of Products without Target Chemicals on the Label	# of Products Detected Target Chemicals	Ingredient label incorrectness rate (%) <Chemical detection rate (%)>	# of products detected above Parabens 100 µg/g	Brand Name
22	5	22.7	2 Toothpaste 1423 and 3 Hand wash 1403- 1884	Mediplus, Colgate, Savlon, Sepnil and Lifebouy

Figure: Labeling and Paraben Concatenation in microgram/ gram

Out of the 22 adult products examined, 5 were identified as having elevated levels of parabens. More precisely, two toothpaste brands (Mediplus and Colgate) were found to contain around 1423 µg/g, while three hand wash brands (Savlon, Sepnil and Lifebouy) exhibited paraben levels ranging from 1403 to 1884 µg/g.

Children Products

Product Category	For Baby/ Kids	Brand Name	Product Name	MP	BP
Tooth Paste	Detected	kodomo	Kodomo toothpaste	659	50.5

Figure: Parabens on Children's products

Out of the 8 children's products examined, it was found that one brand of toothpaste (Kodomo) contained 659 µg/g of methyl paraben and 50.5 µg/g of butyl paraben. Kodomo is one of the highest selling brands for children in Bangladesh, hence, it is a matter of concerning.

Floride Detection

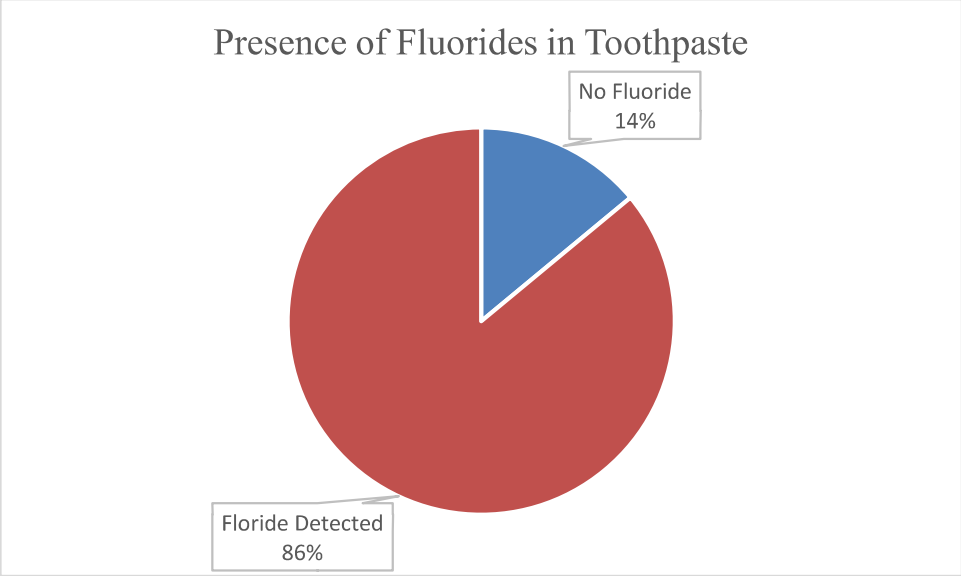


Figure: Detection of Fluorides in Toothpaste

Within the toothpaste samples tested, 86% of them (12 out of 14) contained a fluoride concentration higher than the threshold of 0.15% (equivalent to 1,500 parts per million). This concentration level exceeds the limit established by the United States Food and Drug Administration (FDA) for fluoride content in toothpaste products.

Sodium dichloride Detection

Sodium dichloride was a consistent component across all the samples analyzed.

Other Chemicals Detection with HS Code

- Saccharin- 29251100
- Xylitol-29054930
- Antimicrobial – 38249090
- Abrasives – 68042260
- Chlorine dioxide-38220019
- Sodium lauryl sulfate (SLS) – 34021190
- Sodium hydroxide (NaOH)– 28151100
- Alcohol-22071011
- PEG/PPG (polypropylene glycol)- 29053200

Incorrect Labels: Ingredients on Label vs. Result by country

No.	Country	# of Products without Target Chemicals on the Label	# of Products Detected Target Chemicals	Ingredient label incorrectness rate (%) <Chemical detection rate (%)>	# of products detected above ∑4Parabens 100 μg/g	
1	NP	25	8	32.0 (8/25)	0	0
2	MY	28	15	53.6 (15/28)	1 (Tooth paste 102 μg/g)	0
3	VN	38	1	2.6 (1/38)	1 (Baby Mouth Wipe 370 μg/g)	0
4	PH	38	5	13.2 (5/38)	0	0
5	IN	65	15	23.1 (15/65)	2 (Mouth Wash 403 μg/g, Face Wash 644 μg/g)	0
6	LK	25	5	20.0 (5/25)	1 (Feminine Wash 1202 μg/g)	0
7	ID	28	6	21.4 (6/28)	0	0
8	BD	22	5	22.7 (5/22)	2 (Tooth paste 1423 μg/g)	3 (Hand Wash 1403–1884 μg/g)
	Total	269	60	22.3 (60/269)	10.0 (6/60)	3.3 (2/60)

Figure: Comparison with other countries

According to the findings, among the eight countries studied, samples collected from Bangladesh exhibited the highest concentration of parabens. Additionally, all 22 samples contained one or more toxic chemicals, with 5 of them specifically containing parabens. Furthermore, among the 22 samples, 5 were identified as having incorrect labeling.

18. Environmental Impacts

The environmental impacts of EDCs stem from their widespread use in personal care products, pharmaceuticals, and some food items, which can lead to their release into the environment through various pathways. Once released, parabens can persist in the environment and have several potential effects:

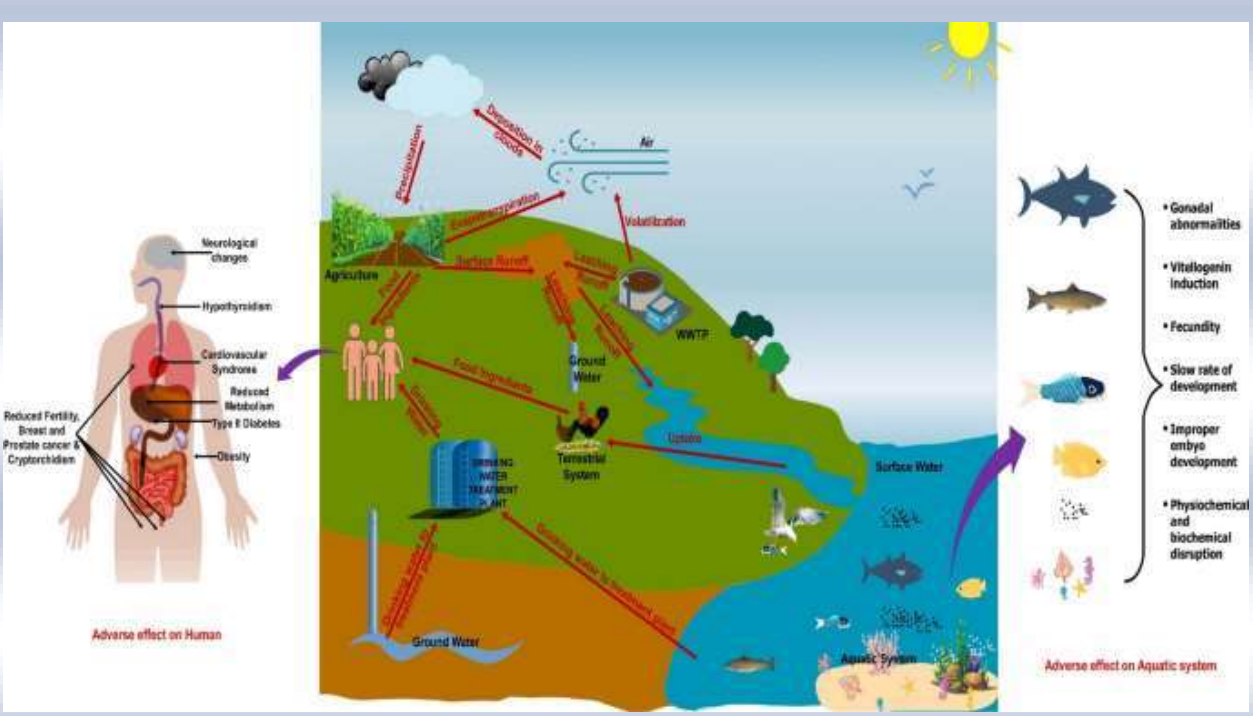


Figure : Impacts of EDCs on the Environment

Ecotoxicity: Parabens have been detected in waterways, sediments, and aquatic organisms, indicating their presence in aquatic ecosystems. These chemicals can exert toxic effects on aquatic organisms such as fish, invertebrates, and algae, potentially disrupting ecosystem dynamics and biodiversity.[24]

Bioaccumulation: Parabens have the potential to bioaccumulate in organisms, meaning they can accumulate in the tissues of living organisms over time. This bioaccumulation can occur through exposure via water, ingestion of contaminated food, or direct contact with products containing parabens. As a result, higher trophic level organisms may experience greater exposure to parabens, magnifying their effects up the food chain.[25]

[24] https://www.sciencedirect.com/science/article/pii/S0048969723059594
[25] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10141211/

Endocrine Disruption: Parabens, due to their ability to mimic estrogen, may disrupt the endocrine systems of wildlife, leading to reproductive abnormalities, developmental issues, and altered behavior. These disruptions can have cascading effects on populations and ecosystems, potentially leading to population declines and changes in community structure.[26]

Persistence: While parabens are generally considered to be relatively biodegradable, some studies suggest that certain forms of parabens can persist in the environment for extended periods, particularly in sediment and soil. This persistence can prolong their environmental impacts and increase the likelihood of exposure to organisms over time.[27]

Interactions with Other Chemicals: Parabens may interact with other chemicals present in the environment, leading to synergistic or additive effects that amplify their environmental impact. For example, interactions between parabens and other pollutants may result in increased toxicity or altered behavior in exposed organisms.[28]

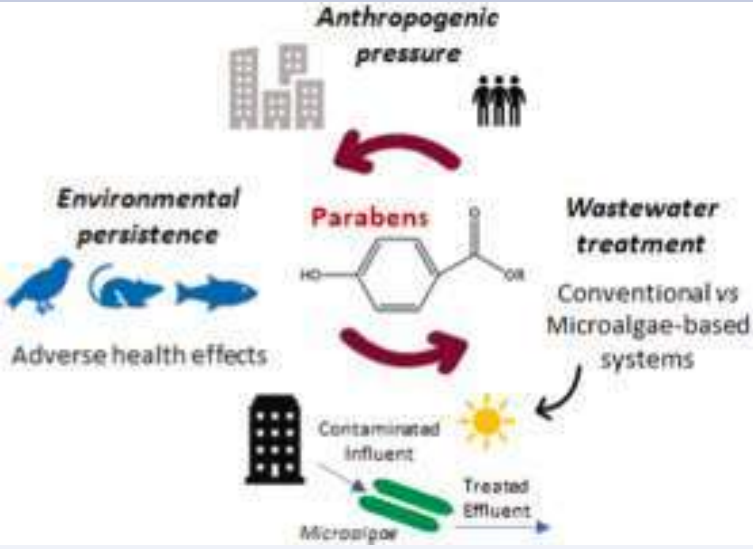


Figure: Parabens in Ecosystem Cycle

Overall, the environmental impacts of parabens highlight the importance of considering not only their direct effects on human health but also their broader ecological implications. Efforts to mitigate these impacts may include stricter regulations on the use and disposal of products containing parabens, as well as increased research to better understand their fate and behavior in the environment.

[26] https://pubmed.ncbi.nlm.nih.gov/33826164/
[27] https://www.sciencedirect.com/science/article/pii/S0959652622008757
[28] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8654909/

19. Conclusion

The study represents that In Bangladesh, the presence of high levels of parabens, fluorides and sodium dichloride's in commonly used products like handwash and toothpaste poses significant concerns for both public health and environmental integrity. Studies have highlighted the potential adverse effects of parabens on human health, including disruptions in hormone regulation, reproductive issues, and even potential carcinogenic effects. Moreover, the widespread use of these chemicals without regulation exacerbates the risk, particularly for vulnerable populations such as pregnant women, infants, and individuals with pre-existing health conditions. Beyond human health, parabens have been detected in environmental samples, indicating their pervasive presence in ecosystems. Once released into the environment through wastewater or product disposal, parabens can accumulate and potentially disrupt the balance of natural systems, with adverse effects on wildlife and overall ecosystem health. The lack of specific regulations addressing these chemicals in Bangladesh leaves consumers unprotected and unaware of potential risks.

In contrast, many countries and regions have already implemented restrictions or guidelines on these groups of chemicals, underscoring the need for similar action in Bangladesh. Effective regulation requires collaboration between government agencies, industry stakeholders, healthcare professionals, and environmental organizations to develop tailored guidelines and enforcement mechanisms. Additionally, raising public awareness about the risks associated with parabens and advocating for regulatory action can empower consumers to make informed choices and drive policy change. By prioritizing the implementation of regulations on EDCs in consumer products, Bangladesh can safeguard public health and environmental well-being for current and future generations.

20. Recommendation

- Further studies and academic research
- Regulation and policy guidelines for restriction of EDCs and setting permissible limits
- Create mass consumer awareness and education for chemical regulations for each chemical
- EPR and polluter pay principles to be adapted for producers and distributors as well
- Knowledge sharing on labeling
- Paraben, Fluoride and Sodium Dichloride should be included in the POPs list

Annex

Image: EDC Free Asia II Conference in South Korea

Image: Sample analyzer tool HPLC

Image: Sample Collection by ESDO Team

Detection of Endocrine disruptors in personal care products in Bangladesh

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