The gendered impact of per- and polyfluoroalkyl substances (PFAS): A new perspective on PFAS exposure research

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Human-Made "Forever Chemicals"

Per- and Polyfluoroalkyl Substances (PFAS) are a group of manufactured chemicals that pose risks to human health.[1] The chemicals have been dubbed "forever chemicals" due to their **inability to degrade** and their **potential to remain in the body forever**. This class of chemicals can also **bioaccumulate and biomagnify**, which is the process of amounts of the chemical building up.[1] The chemicals are common in manufacturing because they increase the durability, waterproofing, and strength of products.

PFAS are **found worldwide** in rainwater, human and animal blood, soil, and food products.[1] Since their development, many health and environmental concerns have come to light. While there are thousands of chemicals in the class, many have proven to have extremely detrimental health effects.[4]

While there has been more research on the exposure due to water and subsequent guidelines, there is a complete lack of understanding of the impact of PFAS through dermal exposure. **While PFAS has been shown to impact fertility and sex hormones, many products that come in close contact with the body have not yet undergone such research.[5]**

Per- and Polyfluoroalkyl *("PAUL-ee-floor-oh-AL-kill")* substances known as PFAS *("PEA-fass")*

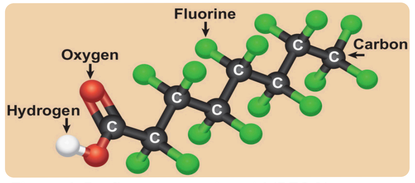

Figure 1: Perfluorooctanoic acid (PFOA), a perfluoroalkyl substance (Source: NIEHS)

Extensive Health Impacts

563
pages in the health effects section of the PFAS toxological report compiled by CDC and ATSDR

1. Increased cholesterol
2. Deceased vaccine response in children
3. Changes in liver enzymes
4. Increased risks of high blood pressure and pre-eclampsia in pregnant people
5. Decreases in infant birth weights
6. Increased risk of obesity
7. Increased risk of kidney cancer
8. Increased risk of testicular cancer
9. Increased risk of prostate cancer
10. Increased risk of asthma
11. Increased risk of thyroid disease
12. Decreased fertility
13. Developmental delays
14. Hormonal disruption
15. Reduced effectiveness of the immune system
16. Delayed eye opening*
17. Changes to brain activity*
18. Changes in skeletal composition*

**Health effects observed in lab model organisms

PFAS in Makeup

PFAS is intentionally added as an ingredient in some makeup products. It is added to products such as foundation, lipstick, eyeliner, and mascara to **increase durability and waterproofing**.[12] Many waterproof products are eyeliners, mascara, and lipstick, which come in close contact with the eyes and mouth. These exposure pathways remain unstudied. According to the FDA, there have been few studies on the presence of PFAS in makeup and there is limited research on dermal absorption.[12] PFAS can also be **present in cosmetic products unintentionally**, due to raw material impurities. Even alleged "clean" beauty brands have **tested positive** for fluorine, which is an indicator of PFAS.

PFAS in Period Products

While there is limited research on dermal exposure from personal care products, there is a complete lack of research on transdermal PFAS absorption through the vulva skin and vaginal mucosa.

Scientific research is lagging behind consumer worries. Environmental Health News and Mamavation, a consumer wellness blog, have collaborated on independent PFAS testing in makeup and personal care products.[11] While the impacts of skin contact with PFAS are still being researched, we know that **uptake of toxic chemicals is already an issue** for tampons and the vagina.

While there are **no current guidelines for acceptable levels of dermal absorption**, research is still needed to develop policy.[7] This direct contact with reproductive organs needs to be further studied.[7] The conversation of PFAS in period products has not yet reached the mainstream discussions of public health. This is extremely concerning due to the prevalence of PFAS in period products and the physiology of the vagina.[7]

The vagina is highly vascular and the mucous membrane of both the vagina and the vulva can rapidly absorb chemicals without metabolizing them.[8] The ability for rapid absorption may also increase levels of chemical exposure.[8] The physicochemical parameters of drug use are still unknown.[9] With pads and period underwear having direct contact with the vulva, and tampons/cups being **used internally**, this could be a **major source of PFAS exposure for menstruators.**

Moving towards a more equitable future

What We Know So Far

- PFAS in personal products has been found, but there is **not a large body of peer-reviewed research**.
- The EPA is developing guidlines for PFAS levels in water, based on current understandings from scientific literature.
- A new EPA rule is requiring reporting of PFAS manufactured and used in the US.

This will be difficult as PFAS is often from contamination.

What is Being Studied

- Best practices to find and measure PFAS
- The extent of harm of PFAS exposure
- Methods of exposure and how PFAS moves through environments
- As awareness increases, more studies of PFAS in consumer products are conducted

Since PFAS is a class of thousands of chemicals, each has to be studied individually which makes progress very slow

References & Contact

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Toddlers have been found to have higher PFAS levels than their own mothers.[13] ***Where is it coming from?***

Diapers

Infant paper diapers are among the **highest contributors of PFAS exposure out of daily exposure doses**.[7] While dust ingestion was previously thought to be the primary mode of exposure, some researchers believe personal hygiene products are another major source.[7] The exposure was found to be **higher in infant paper diapers** than adult paper diapers.[7]

Breast Milk

PFAS can **pass through the parent to the baby** through breast milk.[13,15] According to the current American Academy of Pediatric Medicine (AAP) guidance, **the benefits of breastfeeding outweigh the risk** of PFAS exposure.[15]

Formula

In known cases of PFAS water contamination, AAP recommends using PFAS-free bottled water or investing in certified PFAS water filters.[15] This **recommendation has many barriers**, as PFAS water data is not available or easily accessible to the public in all areas. Those who consume PFAS-contaminated water are likely unaware.

PFAS in Baby Products

PFAS in Infants

In a study in the Netherlands, toddlers were found to have higher amounts of PFAS in their blood than their mothers. The main determinants are identified as **transplacental transfer, prenatally, and breastfeeding, postnatally as exposure pathways Maternal PFOS, PFOA, PFHxS and PFHpS concentrations at delivery,as well as breastfeeding duration**, were important predictors of PFAS concentrations in toddlers.[13] Placental transfer of PFAS has also been studied.[14]

The Bottom Line: What Comes Next?

Research

No existing research on uptake via the vaginal tissue
- Research on dermal exposure to PFAS is needed, with specialized research on uptake of PFAS via vaginal tissue
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Limited research of the prevalance in period products
- Need peer reviewed research on flourine testing, not just independent lab testing
- Need **expansive testing of all products used by menstators** (tampons, pads, liners, mentral cups and discs, reusable/cloth pads, sponges, and period underwear)
- This also must include the **packaging, applicators and layers of products** to isolate where the PFAS originates from

Awareness

- The public deserves to be aware of potential dangers in their health and personal care products
- Corporations and the lack of governmental regulation only continues when this is
- happening without public awareness
- **The gendered impact of male dominated scientific research impacts what is studied**
- Period products and baby products need to be safe for all people

Advocacy

- Politicans and government offices need to be held accountable in protecting citizen safety
- **Enviromental justice must be a priority**, as the complex issue of PFAS is dealt with
- Corporations must be held **accountable** for being aware of what is in their products, including all sources of potential contamination
- The federal government must make more serious regulations to the development of potentially hazardous chemicals