

# BPA Substitutes and Obesity

**A review of the epidemiology and pathophysiology**

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# Introduction: Obesity

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Obesity = BMI greater than or equal to 30 kg/m<sup>2</sup>

Risk factor for:

- T2DM
- CAD
- HTN
- Dyslipidemia
- Sleep apnea
- Stroke
- Osteoarthritis
- Various cancers

According to the World Health Organization, the worldwide prevalence of obesity has tripled since 1975.

# Introduction: “Obesogens” and BPA

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**Obesity** develops from an energy imbalance caused by physical inactivity, excess dietary consumption, or both. However, the development of obesity can be **influenced by a multitude of different environmental and societal factors**.

**Endocrine disruptors:** exogenous compounds found in the environment that can interact with endocrine pathways in the body and contribute to disease

- Called “**obesogens**” when in reference to obesity; one of the factors that can play a role in the pathogenesis of obesity

**Bisphenol A (BPA):** compound used in the manufacturing of polycarbonate plastics and epoxy resins that has been shown to exhibit obesogenic activity

- Found in metal cans, water bottles, piping, thermal paper, and dental sealants
  - Can leach BPA into the environment and food



Image credit: [Epoxycraft.com](http://Epoxycraft.com)

# Introduction: BPA-Substitutes and Obesity

While the trend of BPA-free products is more prevalent now than in the past, concern still remains about the compounds that replace it, such as **BPS** and **BPF**. Both of these BPA substitutes have been shown to have endocrine disrupting activity with regard to androgenicity and estrogenicity.

**The purpose of this review is to assess the current literature on BPA substitutes and their relation to obesity.**

This review seeks to:

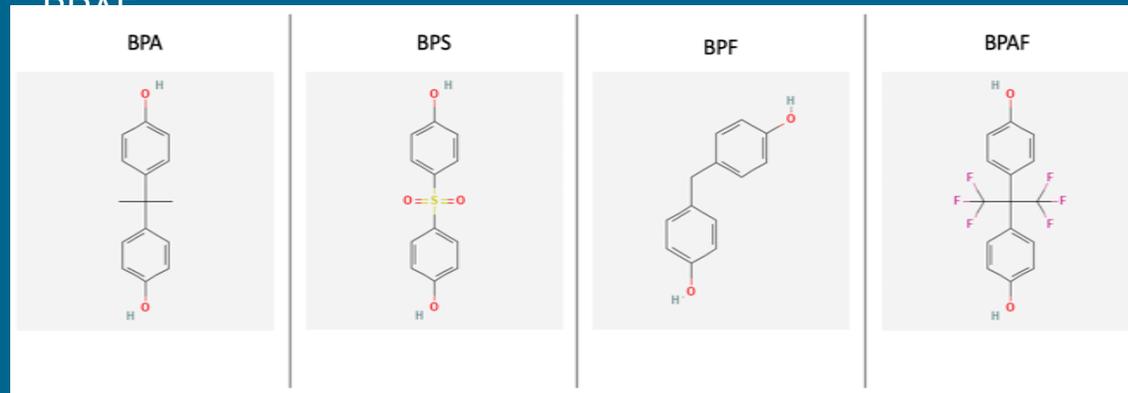
- describe our current understanding of the epidemiology of BPA substitutes in relation to obesity.
- explore the pathophysiology behind BPA substitute exposure and obesity.



Image credit: [valescientific.org](http://valescientific.org)

# Background: Chemical Structures and Sources of Exposure

Figure 1: The 2D chemical structures of BPA, BPS, BPF, and BPAF



- Exposure sources of BPA substitutes:
  - Environmental sources: Indoor dust, water, sewage, sediments
  - Food
  - Consumer products: personal care products, thermal receipt paper, recycled paper products
- Most prevalent BPA substitute = BPS

# Epidemiology

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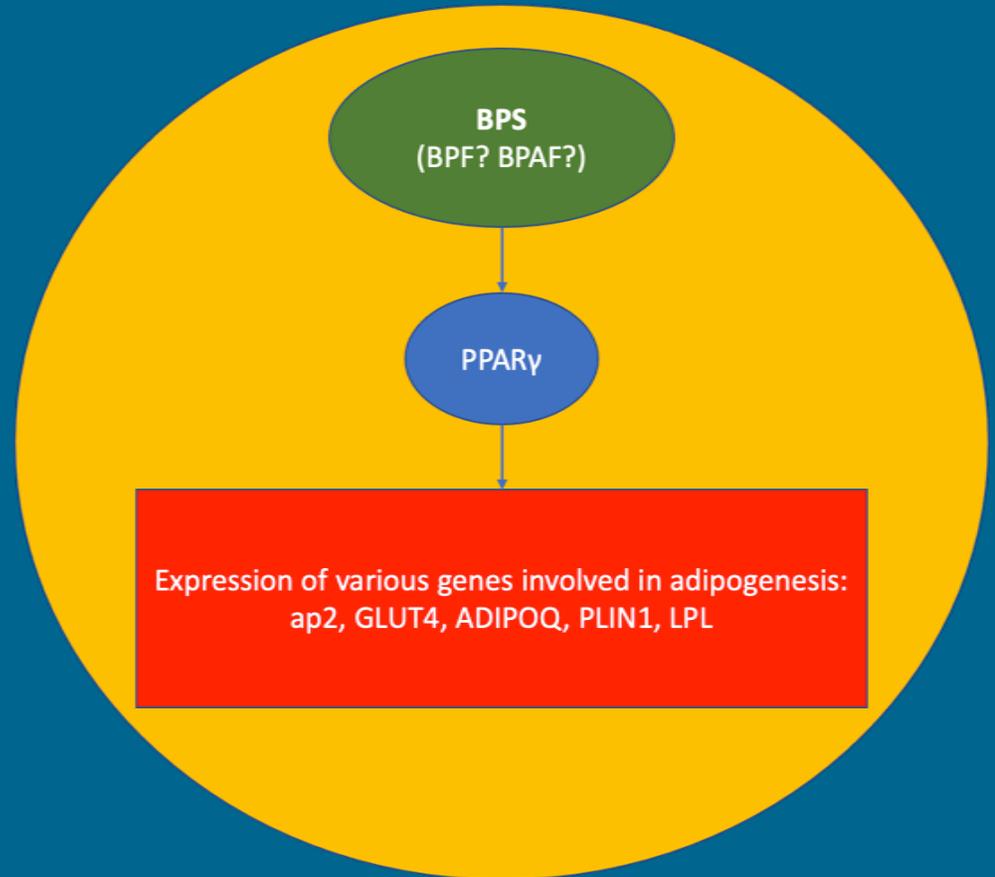
**What do population-based studies suggest about the relationship between BPA substitutes and obesity? There is an...**

- Association between BPA substitute exposure and obesity
  - In adults
  - In children and adolescents
- Association between BPA substitute exposure and obesity-related disease
  - T2DM and HTN

How can this relationship be explained at the pathophysiological level?

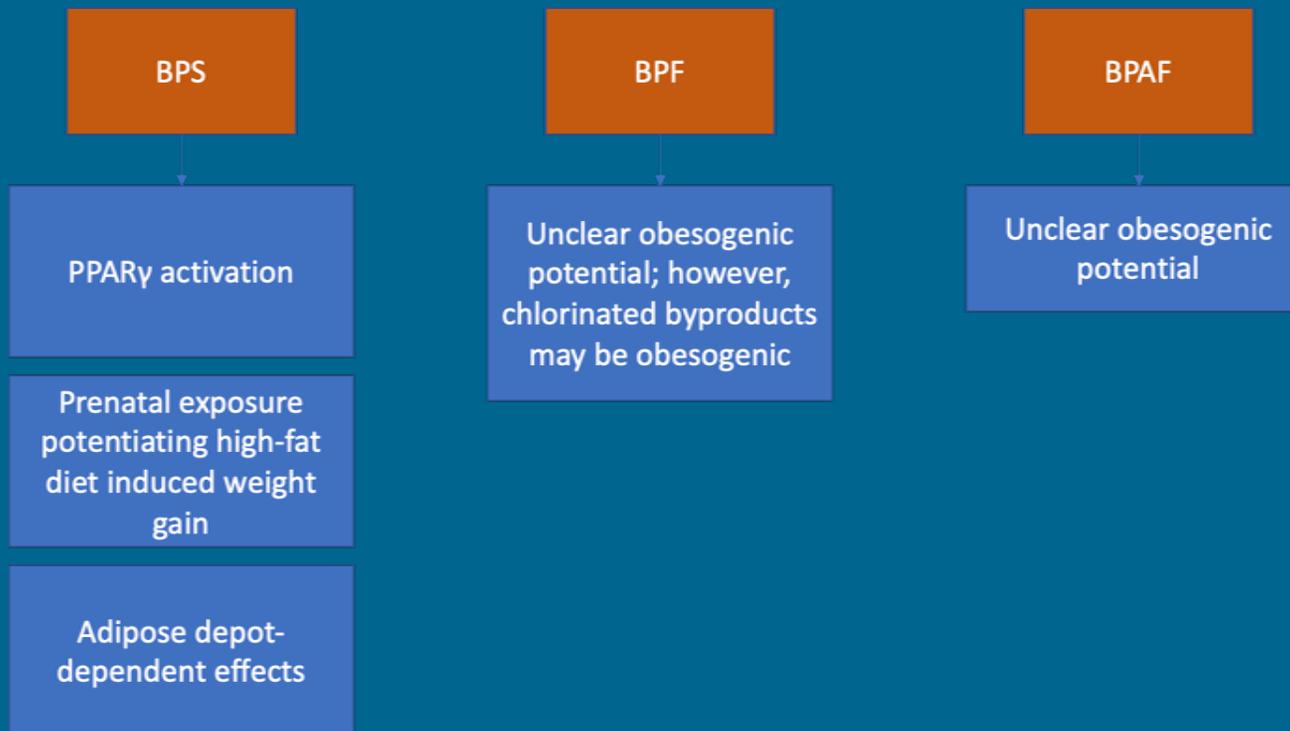
# Pathophysiology: PPAR $\gamma$ - master regulator of adipogenesis

**Figure 2:** The pathophysiological link between BPA substitutes and obesity is most likely through PPAR $\gamma$  activation.



# Pathophysiology: Obesogenic Mechanisms

**Figure 3:** Possible mechanisms by which BPA substitutes act as obesogens



# Discussion

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- Are public health measures warranted given our current understanding of these compounds?
  - In June of 2020, Switzerland became the first country to ban both BPS and BPA in thermal paper.
- In the primary care setting, obesity is one of the most common conditions seen in patients.
- It will be increasingly important for PCPs to be aware of the environmental and social factors that contribute to obesity.

# References

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**SCAN ME**