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ABSTRACT

A group of chemicals widely known as the “forever chemicals” have been a part of many manufacturing processes since the 1940s due to their useful properties. Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic compounds that remain persistent in the environment after entry. They can run off from facilities that use or produce PFAS and through products such as fire extinguishing foam, making them present in water, soil, air, and food, and are added to materials found at home such as cleaning products, non-stick cookware, cosmetics, and fast-food containers. PFAS have been known to build up in our blood, and in recent years have emerged as a possible environmental and human health risk. Recent studies have investigated the potential impact of PFAS exposure on immune function, including vaccine response. Extensive literature review was carried out on several observational studies to investigate whether PFAS exposure affects the efficacy of vaccines, focusing mainly on antibody production. The research covered a wide range of populations, with variety in age, location, and serum concentrations of common PFAS. Results varied among age group, sex, and tested antibody. Findings from a long-term observational study suggest that higher PFAS concentration has a small negative effect on antibody concentrations in some age groups following vaccination for some viruses. Another study found that when more PFAS are present in blood, it's suggested to have an association with reduced COVID-19 antibody concentration. In addition, a study on individuals who regularly drank water from PFAS-contaminated waters found that higher concentrations had a negative association with antibodies for influenza. While research has suggested that PFAS can affect vaccine efficacy through hampering antibody production, some studies find no significant correlation between PFAS and antibody concentrations in adults. More studies are warranted to determine the potential effect of PFAS on antibody production.

OBJECTIVES

- Examine existing literature to determine possible effects of PFASs on the immune system and their implications for public health.
- Assess risks of widespread PFAS use regarding vaccine response and the immune system.
- Consider future research that should be conducted to achieve a better understanding of the impacts of PFAS exposure in humans.

METHODS

- Literature search was conducted using Google Scholar and Michael Schwartz Library databases
- Key terms used: “PFAS and vaccine response,” “PFAS and immune system,” “serum antibodies”

RESULTS

- In terms of COVID-19, researchers measured IgG and neutralizing antibody concentrations. IgG concentration lowered by 3.45% with 14.5 ng/mL increase in PFOS. Results for neutralizing antibody for PFOA were similar (Figure 1).
- Another study shows no decrease in Ig2 spike antibodies despite the test subjects having a high level of PFOA and PFOS. (Figure 2).
- Age was not found to be a factor in determining effects of PFAS chemicals on vaccine response.

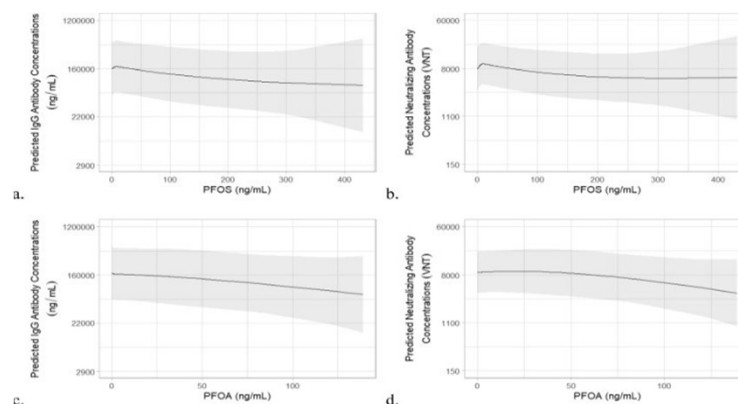


Figure 1. Predicted IgG and Neutralizing Antibody Concentration vs PFOA/PFOS Concentration

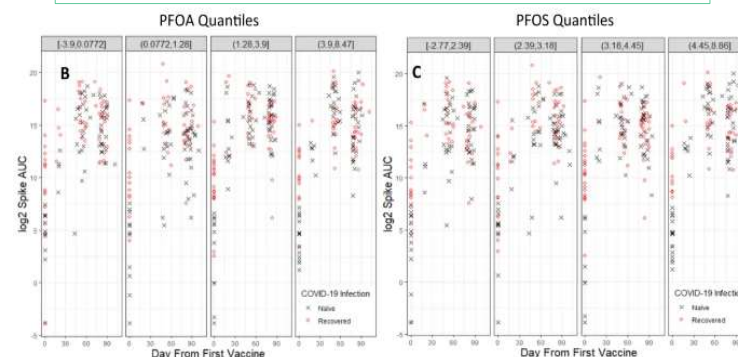


Figure 2: PFOA/PFOS Quantity vs Ig2 Antibodies over time

- In terms of hepatitis A and B, no significant associations of PFAS and antibody concentrations were found. However, an inverse association between PFOA concentration and antibodies for hepatitis A (anti-HAV) was observed at ages 14 and 28 years.
- Similar trends were found for hepatitis B (anti-HBs) at age 22 and 28 years.

- Negative associations between anti-HAV and anti-HBs and PFAS at birth, 7, and 14 years were found among women, but positive associations were observed among men.
- In addition, PFAS concentrations were positively associated with anti-HAV and anti-HBs at age 7 years in females only.

CONCLUSION

Based on the research conducted and the studies considered, there is a clear lack of repetition of results to determine if high levels of per- and polyfluoroalkyl substances affect vaccine response. Some studies demonstrate a negative correlation between antibody concentration and PFOA/PFOS concentration. However, opposing evidence shows no significant relationship between the two. Therefore, further studies need to be conducted to fully determine any effects on vaccine response.

FUTURE WORKS

- Explore sex-specific differences in PFAS exposure and antibody production
- More research on how PFAS affect the vaccine response on a molecular level

REFERENCES

