The influence of cigarette, electronic cigarette and dual use exposure on maternal immune profiles

Ashford, K., McCubbin, A., Wiggins, A.T., Barnett, J., Blair, L., Ducas, L., Ward, C., O'Brien, JM.

Objective

Although maternal tobacco use is known to alter serum cytokine concentrations, no data exist regarding the influence electronic cigarettes (e-cigs) exposure on the maternal immune profile. The purpose of this study was to describe differences in the cytokine profiles of pregnant e-cig users compared to conventional cigarette smokers and non-smokers.

Study Design

Between 2007 and 2019, a multi-site, prospective cohort study of women with validated tobacco use enrolled participants and controls up to 26 weeks gestation. Serum cytokines (Interleukin (IL)-1β, IL-2, IL-6, IL-8, IL-10, TNFα) CRP, and MMP-8 were measured using a multiplex electrochemiluminescent plate assay during the second trimester (mean gestational age = 22.5 weeks, SD = 1.9). Cytokine levels were log transformed prior to analysis. Analysis of Covariance assessed differences by tobacco use group, adjusting for age and BMI. Post-hoc comparisons were accomplished using Fisher's Least Significant Differences (LSD) method. All analysis was conducted using SAS v 9.4, with an alpha of .05.

Results

387 participants were enrolled and stratified into conventional cigarettes only (n=132), e-cig only (n=26), conventional + e-cig (dual) (n=96), and nonsmoker (n=133) groups. Adjusting for age and BMI, all tobacco use groups had significantly lower serum levels of IL-6, IL-8, IL-10, CRP, and TNFα concentrations compared to nonsmokers. Conventional only users also had significantly higher levels of IL-1b and IL-10 compared to dual and e-cig only users, and significantly higher CRP compared to dual users. In the e-cig only group, non-significant differences in cytokine profiles were noted compared to dual users.

Conclusion

Significant differences were observed in multiple serum cytokines between pregnant cigarette and e-cig users versus non-smokers suggesting a causal association between these exposures and an impaired maternal immune profile. E-cig exposure resulted in a unique profile of cytokines compared to conventional users, which may improve clinical outcomes and requires further study.

Table 1. Second trimester serum cytokine adjusted geometric means and standard errors across tobacco use groups

	Conventional only (*n* = 132)	Dual (*n* = 96)	E-cigarette only (*n* = 26)	Nonsmoker (*n* = 133)	Type III test *F* (*p*)
IL-1β pg/mL	0.13 (1.13)[a]	0.06 (1.15)[b]	0.06 (1.32)[b]	0.91 (1.13)[a]	84.5 (<.001)
IL-2 pg/mL	0.11 (1.19)	0.07 (1.19)	0.08 (1.39)	--	2.0 (.13)
IL-6 pg/mL	0.76 (1.11)[a]	0.64 (1.14)[a]	0.68 (1.28)[a]	2.61 (1.11)[b]	32.0 (<.001)
IL-8 pg/mL	2.79 (1.08)[a]	2.35 (1.09)[a]	2.26 (1.19)[a]	5.53 (1.08)[b]	23.4 (<.001)
IL-10 pg/mL	0.71 (1.12)[a]	0.32 (1.15)[b]	0.30 (1.30)[b]	7.70 (1.12)[c]	128.6 (<.001)
TNFα pg/mL	2.72 (1.08)[a]	2.23 (1.09)[a]	2.35(1.19)[a]	7.42 (1.08)[b]	46.3 (<.001)
CRP mg/L	11.06 (1.10)[a]	6.48(1.12)[b]	7.44 (1.24)[a,b]	36.7 (1.10)[c]	56.3 (<.001)
MMP-8 ng/mL	30.88 (1.08)[a]	38.23 (1.10)[a]	35.81 (1.19)[a]	15.79 (.08)[b]	21.7 (<.001)

Note: IL-2 not available from nonsmokers.

Means with different letters significantly differ in post-hoc analysis.