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# The Relationship of Urinary metabolites of carbaryl/naphthalene and chlorpyrifos with Human Semen Quality

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Running head: Pesticides and human semen quality

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Abbreviations:

1N: 1-naphthol.

CASA: Computer-aided semen analysis.

CDC: Centers for Disease Control and Prevention.

CRE: Creatinine.

LIN: Linearity.

LOD: Limit of detection.

ROS: Reactive oxygen species.

SG: Specific gravity.

TCPY: 3,5,6-trichloro-2-pyridinol.

VCL: Vigor curvilinear velocity.

VSL: Vigor straight line velocity.

WHO: World Health Organization.

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## ABSTRACT

A majority of the general population is exposed to carbaryl and other contemporary-use insecticides at low levels. Studies of laboratory animals in addition to limited human data show an association between carbaryl exposure and decreased semen quality. The present study explored whether environmental exposures to carbaryl and chlorpyrifos are associated with decreased semen quality in humans. Subjects (N= 272) were recruited through a Massachusetts, USA infertility clinic. Individual exposures were measured as spot urinary metabolite concentrations of chlorpyrifos (3,5,6-trichloro-2-pyridinol; TCPY) and carbaryl (1-naphthol; 1N), adjusted using specific gravity. Semen quality was assessed as sperm concentration, percent motile sperm, and percent sperm with normal morphology, along with sperm motion parameters (straight-line velocity, curvilinear velocity, and linearity). Median TCPY and 1N concentrations were 3.22 and 3.19  $\mu\text{g}/\text{l}$ , respectively. For increasing 1N tertiles, adjusted odds ratios were significantly elevated for below reference sperm concentration (OR for low, medium and high tertiles= 1.0, 4.2, 4.2; p-value for trend= 0.01) and percent motile sperm (1.0, 2.5, 2.4; p-value for trend= 0.01). The sperm motion parameter most strongly associated with 1N was straight-line velocity. There were suggestive, borderline-significant associations for TCPY with sperm concentration and motility, while sperm morphology was weakly and non-significantly associated with both TCPY and 1N. The observed association between altered semen quality and 1N are consistent with previous studies of carbaryl exposure, while suggestive associations with TCPY are difficult to interpret because human and animal data is currently limited.