Pesticide residues and semen quality

Sir,

We read with interest the study of Chiu and associates published in Human Reproduction (Chiu et al., 2015) and would like to raise several questions. The data presented in Table III demonstrate that there was no difference in sperm concentration between the high and low-to-moderate pesticide exposure groups. The majority of the difference in total sperm count, which was significantly lower in the high pesticide residue when compared with the low-to-moderate group, was secondary to differences in ejaculate volume between the highest and lowest quartiles.

In reviewing the methods, men were instructed to abstain from ejaculation for at least 48 h, but no more than 5 days before producing a semen sample. Semen volume, however, can vary with days of sexual abstinence (Carlsen et al., 2004; De Jonge et al., 2004), and this information is critical in interpreting the data. This is especially the case as the number of men in each of the quartiles was not large. Although 338 ejaculates from 155 men were studied, 51 men provided only a single sample and 51 provided two samples. It would be critical to know the mean and standard deviation of sexual abstinence for each of the quartiles, in analyzing whether this may have influenced the results. Also, if the fourth quartile were excluded (significantly lower volume) in the analysis, were the differences between quartiles 1 to 3 significant?

While the results demonstrate that men in the highest quartile of high pesticide residue fruits and vegetables had fewer morphologically normal sperm, increasing intake of low-to-moderate pesticide residue was positively related to sperm morphology. The authors provide no explanation of this observation. The four quartiles of sperm morphology in the high pesticide residue group in Table III are a mirror image of those in the low-to-moderate group. Based on their prior reasoning, one might argue that small amounts of pesticide residue improved sperm morphology.

References


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Reply: Pesticide residues and semen quality

Sir,

We thank Dr Bronson for his interest in our research article on fruit and vegetable intake and their pesticide residues in relation to semen quality in the EARTH study (Chiu et al., 2015). As pointed out by Dr Bronson (Bronson, 2015), ejaculate volume can vary according to the length of sexual abstinence (De Jonge et al., 2004), and should therefore be considered when interpreting the negative association between intake of high pesticide residue fruits and vegetables with total sperm count in our study. In our report we account for abstinence time by including length of abstinence as a covariate in the multivariable models. To further address this point we conducted an additional analysis restricted to semen samples collected after a minimum of 2 days and a maximum of 7 days of sexual abstinence (n = 121, 194 semen samples), as recommended by the World Health Organization (WHO, 2010). The findings of this additional analysis were consistent with those reported in our manuscript. Specifically, total adjusted sperm count [million (95% CI)] for men in increasing quartiles of high pesticide residue fruit and vegetable intake were 178 (138, 229), 175 (133, 231), 126 (93, 170), and 77 (52, 113) (P, trend = 0.001) when abstinence time was modeled as a categorical variable, and 167 (130, 216), 165 (125, 217), 118 (90, 154), and 71 (49, 102) when abstinence time was modeled as a continuous variable (P, trend = 0.0008). These results show that abstinence time does not explain the negative association between intake of high pesticide residue produce and sperm count.

Dr Bronson also noted the lack of explanation for a positive association between low-to-moderate pesticide residue fruit and vegetable intake and sperm morphology (P, trend = 0.04). As pointed out in the results section, this relation was not present in the sensitivity analyses included in our manuscript. As a result, we were less confident in this finding and therefore focused our discussion on the more robust finding of the negative relation between high pesticide residue and semen quality. However, this should not be interpreted that low pesticide residue produce intake may not be beneficial to male fertility. Several studies have shown that intakes of nutrients concentrated in fruits and vegetables like lycopene, cryptoxanthin, vitamin C, and beta-carotene, are associated with higher sperm quality (Eskenazi et al., 2005; Minguez-Alarcon et al., 2012; Zareba et al., 2013). Furthermore, rather than the interpretation that small amounts of pesticides may improve sperm morphology we believe that our results are consistent with a biological interaction between pesticide residues in particular (and environmental chemicals more generally) and diet. Specifically, our findings suggest that in the presence of large amounts of dietary pesticides, the positive effects of antioxidants and other beneficial constituents of fruits and vegetables may be masked while at low levels of dietary pesticides they can be identified. Similar interactions have been previously identified including a study in China reporting an interaction between 1,1,1-trichloro-2,2-bis (chlorophenyl)-ethane (DDT) and serum vitamin B levels on clinical