Sex Chromosomes and Gonad Dependent Sex Differences in Auditory Function in Mice

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Background

Sex differences in the auditory system are a well-established phenomenon across many species. In humans, women display better hearing across most age groups and lose hearing slower as they age than men. While gonadal hormones have been linked to women's greater auditory function, the molecular and cellular mechanisms causing sexual dimorphism are unclear. In this study, we utilize four core genotype (FCG) mice, a model for investigating the sex chromosome effect, to examine the role of sex chromosomes and gonads in the maintenance of normal auditory function.

Methods

FCG mice were generated by manipulating the testis-determining gene, *sry*, located on the Y chromosome to produce four mice: XX females, XY females, XX males and XY males. Auditory brainstem response (ABR) tests were performed to measure thresholds and waves I amplitudes and latencies in XXF, XYF, XXM, and XYM mice at one month of age. Along with ABR, Distortion Product Otoacoustic Emissions (DPOAE) tests were completed to determine the DPOAE amplitude at 1 month of age.

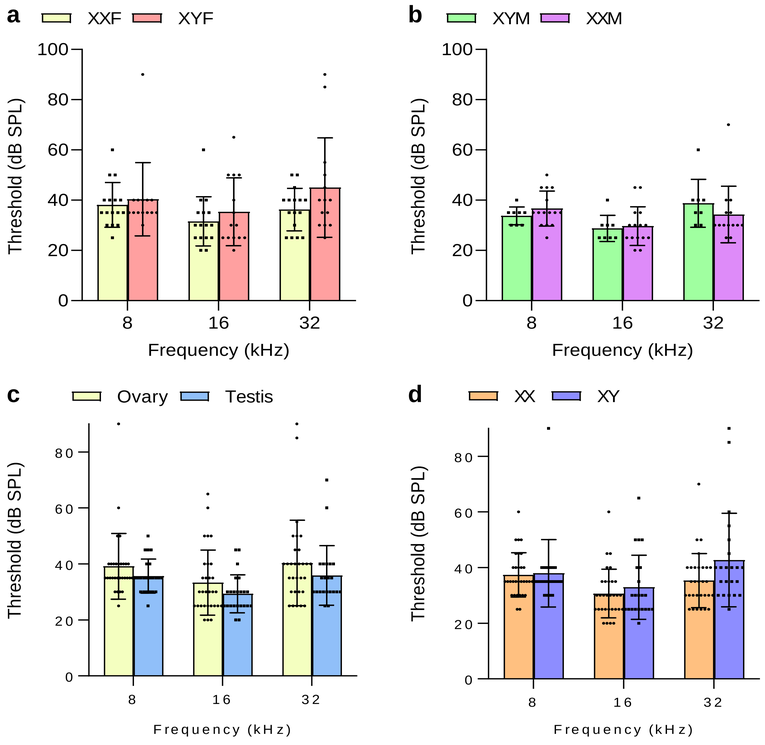

Figure 1: Assessment of ABR thresholds. ABR thresholds were measured with tone burst stimuli at 8, 16, and 32 in XXF (n=17), XYF (n=14), XYM (n=8), and XXM (n=15) mice at 1 month of age. Two-way ANOVA used to determine significance. Data are shown as means ±SD.

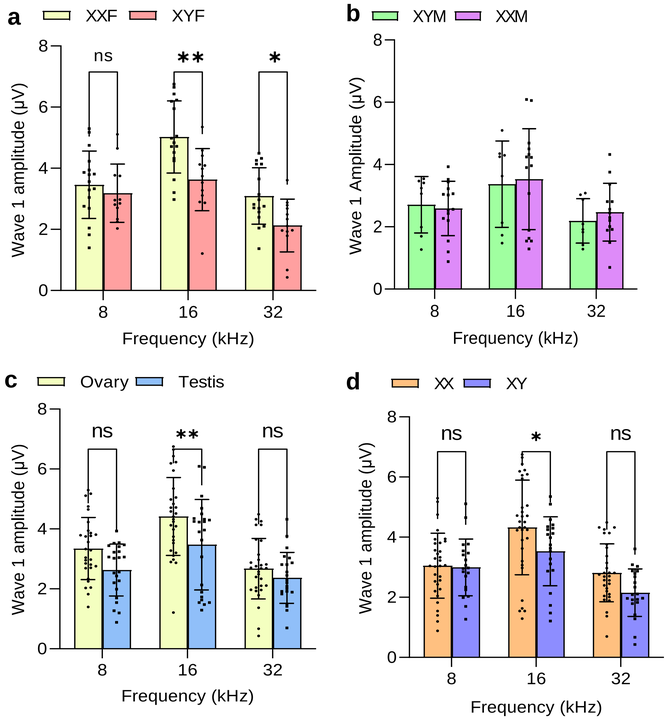

Figure 2: Assessment of ABR wave 1 amplitude. ABR wave 1 amplitude was measured at 8, 16, and 32 kHz at 90 dB SPL in 1-month-old XXF (n=17), XYF (n=14), XYM (n=8), and XXM (n=15) mice. Two-way ANOVA used to determine significance. Data are shown as means ±SD. *$P < 0.05$.

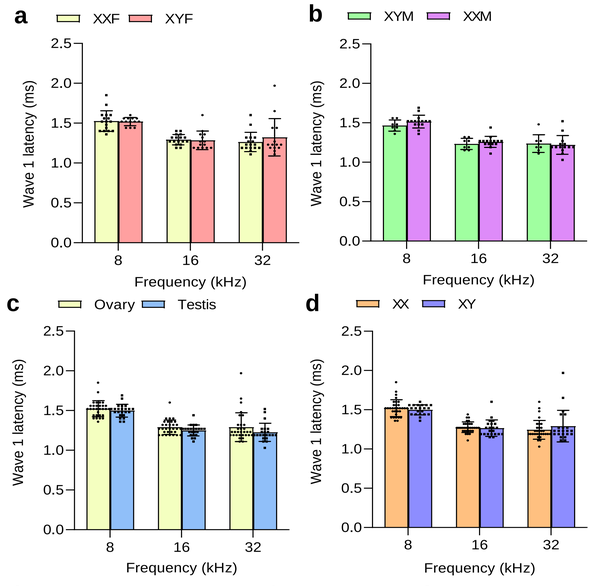

Figure 3: Assessment of ABR wave 1 latency. ABR wave 1 latency was measured at 8, 16, and 32kHz at 90 dB SPL in 1-month-old female XXF (n=17), XYF (n=14), XYM (n=8), and XXM (n=15) mice. Two-way ANOVA used to determine significance. Data are shown as means ±SD.

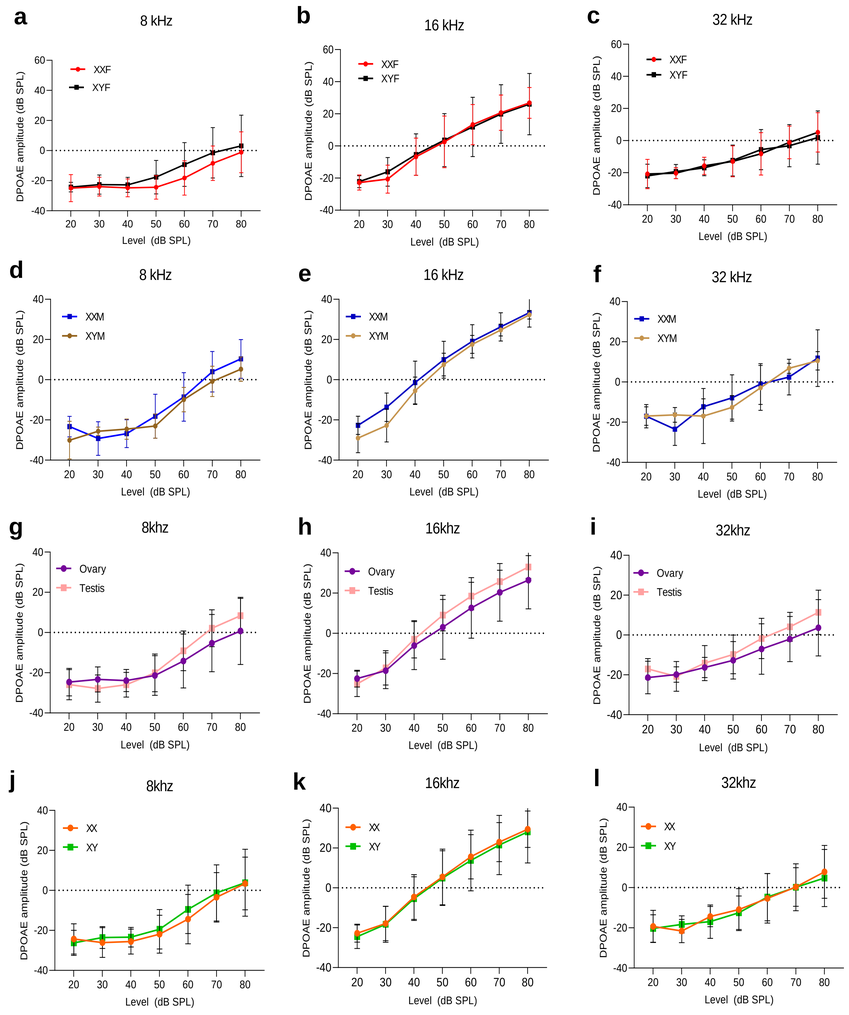

Figure 4: Assessment of DPOAE amplitudes. DPOAE amplitudes were measured at 8 kHz in XXF (n=12), XYF (n=10), XXM (n=8), and XYM (n=5) mice at 1 month of age. Two-way ANOVA used to determine significance. Data are shown as means ±SD.

Conclusions

These results suggest that auditory function is influenced by sex chromosomes and gonads. In female FCG mice, wave 1 amplitude is positively influenced by the presence of a second X chromosome and ovaries. This suggests a potential synergistic relationship between the two leading to the improved hearing sensitivity demonstrated by females compared to males.