

A network algorithm for the X chromosomal exact test for Hardy-Weinberg equilibrium with multiple alleles

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Abstract

Statistical methodology for testing Hardy-Weinberg equilibrium at X chromosomal variants has recently experienced considerable development. Up to a few years ago, testing X chromosomal variants for equilibrium was basically done by applying autosomal test procedures to females only. At present, male alleles can be taken into account in asymptotic and exact test procedures for both the bi- and multiallelic case. However, current X chromosomal exact procedures for multiple alleles rely on a classical full enumeration algorithm and are computationally expensive, and in practice not feasible for more than three alleles. In this article we extend the autosomal network algorithm for exact Hardy-Weinberg testing with multiple alleles to the X chromosome, achieving considerable reduction in computation times for multi-allelic variants with up to five alleles. The performance of the X-chromosomal network algorithm is assessed in a simulation study. Beyond four alleles, a permutation test is, in general, the more feasible approach. A detailed description of the algorithm is given and examples of X chromosomal indels and microsatellites are discussed.

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