THE POWER OF CHI-SQUARE TYPE GOODNESS-OF-FIT TEST STATISTICS FOR THE HARDY-WEINBERG LAW

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The asymptotic Pearson's Chi-Square test is commonly used in the forensic setting to determine if genotype frequencies adhere to the Hardy-Weinberg law. The genetics literature and elsewhere contains a number of exact test techniques to deal with the regularly occurring small sample size problem. In power studies for discrete data the statistics literature has traditionally focused on comparing Pearson's Chi-Square with discrete empirical distribution type test statistics where typically power is approximated for a uniform null against several predefined alternative distributions. This paper focuses on the relative power of the lesser used Chi-Square type test statistics that can also be used to test the Hardy-Weinberg law. A simulation study is used to assess and compare the powers of four asymptotically Chi-Squared distributed test statistics: Pearson's Chi-Square, Log-Likelihood Ratio, Freeman-Tukey and Power Divergence with $\lambda=⅔$. The power study is based on a ten year old data set of a large number of genotypes at the HUMTH01 locus and another dataset from the literature based on a small number of genotypes. The null distribution is obtained from the probabilities from the Hardy-Weinberg law and the fully predefined alternative distribution of the genotype probabilities are obtained by varying the value of the imbreeding coefficient. The results show that differences in the relative power of these test statistics exist which make it difficult, in terms of power, to recommend one Chi-Square type test statistic over the others.