The secondary structure of DNA is variable and depends on the sequence of nucleotides in a strand. While DNA can form duplexes, formations of three, four, or even a single strand have been observed *in vivo* and *in vitro* as well. In this thesis, we study the effect of small changes of oligonucleotide sequences on the stability of hairpins formed by DNA heptamers by ^{1}H nuclear magnetic resonance (NMR) spectroscopy. Suitable DNA sequences were selected based on symmetry rules and stability prediction by nearest neighbor model. Two-dimensional ^{1}H -^{1}H NOESY spectra were used to assign the ^{1}H resonances of aromatic hydrogens. Variable-temperature 1D spectra served for obtaining melting curves, from which the thermodynamic properties of the hairpins were determined. The presence of hairpins in the solutions was confirmed by the character of the NOESY spectra, independence of melting temperature on oligonucleotide concentration, and comparison of competing melting-curve models of duplex and hairpin. Our results point out the importance of the order of the stem base pairs and contribute to the description of the extraordinary stability of DNA mini-hairpins.