We write down the renormalization-group equations for the Yukawa-coupling matrices in a general multi-Higgs-doublet model. We then assume that the matrices of the Yukawa couplings of the various Higgs doublets to right-handed fermions of fixed quantum numbers are all proportional to each other. We demonstrate that, in the case of the two-Higgs-doublet model, this proportionality is preserved by the renormalization-group running only in the cases of the standard type-I, II, X, and Y models. We furthermore show that a similar result holds even when there are more than two Higgs doublets: the Yukawa-coupling matrices to fermions of a given electric charge remain proportional under the renormalization-group running if and only if there is a basis for the Higgs doublets in which all the fermions of a given electric charge couple to only one Higgs doublet. (c) 2010 Elsevier B.V. All rights reserved.