The left ventricle (LV) of the heart is known to adapt its structure and function during disease, such as diabetes and myocardial infarction. This can lead to regional thickening or thinning of the LV wall, and enhancement or degradation of regional muscle function. The overall aim of our research is to use mathematical modelling to analyse the effects of adaptation in animal studies of diabetes and myocardial infarction. In this study, we used a finite element approach to create a canine LV mathematical model based on geometric data obtained from clinical magnetic resonance imaging (MRI) made available by our collaborators at the NIH. These MR images incorporated tissue tagging which enabled the tracking of LV wall deformation throughout the cardiac cycle. Initially, a regular ellipsoid was constructed based on the base-to-apex dimension and wall thickness estimated from MRI of a canine heart in the end-diastolic state. The epicardial and endocardial surface data segmented from the MRI tissue tags were used with nonlinear finite element fitting techniques to generate a customised canine LV geometrical model from the initial ellipsoid. Myofiber orientations obtained from diffusion tensor MRI from the same heart are incorporated into this customised LV model using free-form deformation. Model parameters, such as the mechanical properties, will be tuned in order to reproduce the observed deformations and ventricular cavity pressures. Tuned models for both normal and diseased conditions enable the comparison of regional LV wall motion and stress throughout the cardiac cycle.