Fish is a highly perishable food product given its high degradation rate caused by 3 state types (pre-rigor/rigor/post-rigor). Thermal processes are used to slow down the degradation process, but impacting the nutritional value and taste properties. In this sense high hydrostatic pressure (HHP) has been used to preserve the quality of seafood. The objective of this study was to evaluate the effect of HHP on thermodynamic and structural protein properties in fish muscle (*Trachurus murphyi*) at different rigor stage. Pressure treatments of 450 and 550 MPa for 3 and 4 min were applied. A Differential scanning calorimeter (DSC) was used to perform thermal analysis. The protein extract was scanned (heating/cooling) at 10°C/min over a temperature range of 10-125°C at ramp rate of 20°C/min. Changes in secondary structure was observed by Fourier transform infrared spectroscopy (FTIR). The obtained spectra (amide I) were smoothed, normalized and a second-derivative spectra were obtained. The state of rigor affects the temperature of denaturation ($T_d$) of myofibrillar proteins, the higher the $T_d$ the better stability ($T_d$ actin > $T_d$ myosin). The denaturation enthalpies ($\Delta H_d$) decreased with HHP indicating a loss of protein structure. The secondary structure of proteins in fish muscle mainly have an aggregate state intramolecular $\beta$-sheet (1631 cm$^{-1}$) and $\alpha$-helix (1646 cm$^{-1}$) structures and the application of HHP cause a reduction of intramolecular and increase of intermolecular $\beta$-sheet aggregate states. In conclusion, thermal stability ($T_d$, $\Delta H_d$) and secondary structure of myofibrillar proteins of fish muscle were affected by the HHP application and rigor state.