We present an estimate of the bolometric X-ray luminosity - velocity dispersion ($L_x - \sigma_v$) relation measured from a new, large and homogeneous sample of 171 low redshift, X-ray selected galaxy clusters. The linear fitting of $\log(L_x) - \log(\sigma_v)$ gives $L_x = 10^{32.72\pm0.08} \sigma_v^{4.11\pm0.3} \text{ erg s}^{-1} \text{h}_{50}^{-2}$. Furthermore, a study of 54 clusters, for which the X-ray temperature of the intracluster medium $T$ is available, allows us to explore two other scaling relations, $L_x - T$ and $\sigma_v - T$. From this sample we obtain $L_x \propto T^{3.1\pm0.2}$ and $\sigma_v \propto T^{1.00\pm0.16}$, which are fully consistent with the above result for the $L_x-\sigma_v$. The slopes of $L_x - T$ and $\sigma_v - T$ are incompatible with the values predicted by self-similarity ($L_x \propto T^2 \propto \sigma_v^4$), thus suggesting the presence of non-gravitational energy sources heating up the intracluster medium, in addition to the gravitational collapse, in the early stages of cluster formation. On the other hand, the result on $\log(L_x) - \log(\sigma_v)$ supports the self-similar model.