Compact objects in torsion-based extended theory of gravity

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We study the static spherically symmetric configurations of the perfect fluid described by the polytropic equation of state (EoS) in the $f(T)$ extended theory of gravity. For $f(T) = T$, where T is the torsion scalar, this gravity theory is equivalent to GR and is known as its teleparallel equivalent (TEGR). In this work, we provide numerical evidence for the existence of the polytropic solutions in $f(T) \neq T$. For certain parameters of the EoS, we obtain sharply vanishing fluid energy density and pressure at finite radius (stellar surface) as in the GR solutions where we can join the interior spacetime with the exterior vacuum spacetime appropriate for the considered variant of the $f(T)$ theory. This result should be seen within the context of the recently formulated no-go theorems for the polytropic spheres in modified gravity theories involving higher order derivatives such as the Palatini $f(R)$ theory or the $\omega = -3/2$ scalar-tensor theory. We think it is important to inspect the well known GR solutions in the framework of the new modified theories as this theories can serve as a test in which direction the new fundamental theories and notions should go.