Abstract. We consider the Finsler space $(\bar{M}^3, \bar{F})$ obtained by perturbing the Euclidean metric of $\mathbb{R}^3$ by a rotation. It is the open region of $\mathbb{R}^3$ bounded by a cylinder with a Randers metric. Using the Busemann-Hausdorff volume form, we obtain the differential equation that characterizes the helicoidal minimal surfaces in $\bar{M}^3$. We prove that the helicoid is a minimal surface in $\bar{M}^3$, only if the axis of the helicoid is the axis of the cylinder. Moreover, we prove that, in the Randers space $(\bar{M}^3, \bar{F})$, the only minimal surfaces in the Bonnet family, with fixed axis $O\bar{x}^3$, are the catenoids and the helicoids.