ABSTRACT

Little is known about the molecular regulation of skeletal muscle protein turnover during exercise in field conditions where energy is intake inadequate. Here, 17 male and 7 female soldiers performed an 8 day long field based military operation. Vastus lateralis muscle biopsies, in which autophagy, the ubiquitin-proteasome system and the mTORC1 signaling pathway where studied, were collected before and after the operation. The 187 h long operation resulted in a 15% and 29% negative energy balance as well as a 4.1% and 4.6% loss of body mass in women and men respectively. After the operation protein levels of ULK1 as well as the phosphorylation of $ULK1^{Ser317}$ and $ULK1^{Ser555}$ had increased by 11%, 39% and 13%, respectively, and this was supported by a 17% increased phosphorylation of $AMPK^{Thr172}$ (P<0.05). The LC3b-I/II ratio was 3-fold higher after compared to before the operation (P<0.05), whereas protein levels of p62/SQSTM1 were unchanged. The β1, β2, and β5 activity of the proteasome and protein levels of MAFbx did not change, while levels of MuRF-1 were slightly reduced (6%, P<0.05). Protein levels and phosphorylation status of key components in the mTORC1 signaling pathway remained at basal levels after the operation. Muscle levels of glycogen decreased from 269±12 to 181±9 mmol · kg dry $muscle^{-1}$ after the exercise period (P<0.05). In conclusion, the 8 days of field based exercise resulted in induction of autophagy without any increase in proteasome activity or protein ubiquitination. Simultaneously, the regulation of protein synthesis through the mTORC1 signaling pathway was maintained.