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Slipping on ice surfaces is one of the main risks for outdoor activities in Nordic countries. The SATRA STM 603 whole shoe tester, used to evaluate the coefficient of friction (COF) of footwear on dry and contaminated indoor surfaces according to standard test methods, can be fitted to a refrigerated ice tray enabling different types of ice surfaces to be built in the laboratory. The SATRA TM144:2011 is the only mechanical test method that provides rough guidelines to test footwear on frosted and smooth ice surfaces. However, scarce information is published about this test method and the repeatability and reproducibility of such tests on ice surfaces have not been assessed. The aim of this study is to evaluate the repeatability and reproducibility of the results obtained with footwear tested on ice surfaces at two different laboratories at the two institutes (IRSST and TRI-UHN). This work is part of a project that compares two tests methods for evaluation of slip performance of footwear on icy surfaces: the SATRA test method and a human-centered test method using TRI-UHN's WinterLab (Hsu et al 2015).

Ice was prepared in a STM 603 ice tray at various temperature set points in both labs. The ice surface temperature was monitored using thermistors installed on top of the ice surface. Ice tray's ice temperatures were configured to match WinterLab's ice temperatures and an ice tray preparation protocol was developed. Ten types of occupational footwear were tested in both labs on melting and cold ice surfaces at different sliding modes (heel forward, flat forward and forepart backward, ASTM 2913-17).

The ice surface temperature fluctuates as a function of the cooling cycle of the ice tray. This fluctuation showed slightly different patterns between the two labs. A specific temperature set point and a restricted temperature range for testing have been determined for each lab to ensure the ice temperatures measured by the thermistors were as similar as possible in both labs. The results obtained in both labs for boots tested on melting ice were equivalent, both in COF values and footwear ranking. For cold ice, although the footwear ranking was equivalent between the two labs, the COF values obtained at the IRSST were systematically higher than those obtained at TRI.

The significant impact of ice surface temperature on COF measurement makes reproducibility between laboratories challenging. The proposed test method on cold and melting ice surfaces were able to discriminate between some boots. However, the SATRA test method might give different rankings compared to a human-centered test method and may need improvement to be reliable on ice surfaces.

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