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Metal resistant halotolerant psychrophilic bacteria from Tirich Mir glacier, Hindu Kush, Pakistan, with antimicrobial activity against clinical isolates

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Cold adapted bacterial isolates were recovered from Tirich Mir glacier, Hindu Kush, Pakistan. Subsurface ice, sediment and glacier melt water were analyzed geochemically and microbiologically. High concentrations of metals like Fe, Na, Ca, Mg and K were detected in the sediment. Total bacterial counts in melt water, subsurface ice, glacier ice and sediment were calculated as 6.09×10^4 , 4.39×10^5 , 1.81×10^5 CFU/ml and 4.01×10^8 CFU/g, respectively. Out of 43, 74% of the isolates were tolerant to 10% NaCl, and were able to grow at up to 36%. The isolates showed maximum tolerance to Fe⁺³ and least to Hg⁺². Isolates showed antimicrobial activity against ATCC (American Type Culture Collection) and bacterial and fungal strains isolated from clinical specimens. On basis of *16S rDNA* gene analysis, the most abundant group was *Proteobacteria* (53%) dominated by *Beta-proteobacteria* (44%). The subgroups of *Proteobacteria* were dominated by *Beta-proteobacteria* (44%), *Gamma-proteobacteria* (40%) and *Alpha-proteobacteria* (16%). We conclude that non-polar glaciers such as of HKKH region, are a rich source of cultivable microbiota and such unexplored cold and frozen habitat should be further explored for understanding the microbial life style, microbial diversity both culturable and unculturable, the role they are playing in cycling of nutrients, climate change and for their potential industrial applications

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