Metabolic power and cost of transport (COT) are common quantifiers for effort when performing tasks including walking and running. Most studies focus on using a range of normal walking speeds over level ground or varied slopes. However, these studies use fixed-speed conditions. Fatigue, stability, metabolic expenditure, heart rate, and many other factors contribute to normal walking speed varying over time. This study aimed to show that allowing a subject to walk with a self-paced speed should correlate to a minimum COT at a given slope. This study also aimed to determine if a preferred slope exists based on minimizing metabolic expenditure or maximizing stability. In this study, subjects walked at four different speed conditions including three fixed speeds (0.75 m/s, 1.0 m/s, 1.25 m/s) and their self-paced speed at five different slopes (–6°, –3°, 0°, 3°, 6°) while metabolic energy expenditure and motion were recorded. The minimum COT occurred at a 3° decline. At this slope, some subjects preferred to walk at a faster speed compared to level ground, whereas other subjects walked with a slower speed compared to level ground. Thus, there was a greater range of self-paced speeds, from 0.745 m/s to 2.045 m/s. In comparison, at a 6° incline, the range of self-paced speeds was much smaller, from 0.767 m/s to 1.434 m/s. The variance among self-paced speeds and slope conditions between subjects suggests that COT, alone, does not explain walking decisions; stability might play a greater role than initially believed. These results provide greater insight into why humans choose to walk at a certain speed over a range of slopes and terrains.

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The public is welcome to attend.