

INTISARI

Pekerja yang terpapar suhu dingin ekstrem di *cold storage* berisiko mengalami *cold stress* akibat kehilangan panas tubuh (*heat loss*) yang melebihi kemampuan adaptasi termal. Rendahnya kemampuan adaptasi terhadap suhu dingin dapat memperburuk gangguan fisiologis, kenyamanan termal, dan performa kognitif. Salah satu strategi pemulihan potensial adalah konsumsi minuman hangat, seperti air putih atau jahe, untuk mempercepat proses *heat gain*, menstabilkan suhu tubuh, meningkatkan kenyamanan termal pasca-paparan dingin, dan mempertahankan performa kognitif. Oleh karena itu, penting untuk mengevaluasi efektivitas konsumsi minuman hangat sebagai intervensi praktis dalam mengurangi dampak paparan dingin ekstrem terhadap pekerja.

Penelitian ini menggunakan data primer yang diperoleh dari eksperimen dengan melibatkan 15 partisipan (7 laki-laki dan 8 perempuan). Eksperimen dilaksanakan dalam ruangan bersuhu dingin yang dibagi menjadi dua ruangan: Ruang A (aktivitas, suhu $-4,58 \pm 1,78^{\circ}\text{C}$) dan Ruang B (istirahat, suhu $24,23 \pm 0,74^{\circ}\text{C}$). Eksperimen dilakukan dalam tiga siklus yang masing-masing terdiri atas dua fase: aktivitas fisik berupa simulasi mengangkat beban selama 10 menit dan istirahat selama 10 menit, untuk setiap siklusnya. Partisipan diberikan perlakuan berupa: tanpa konsumsi minuman (CONT), konsumsi air hangat (WW), dan konsumsi minuman jahe hangat (GW), masing-masing dengan volume sebesar 200 mL. Pengukuran dilakukan terhadap parameter fisiologis (suhu timpani, suhu kulit, detak jantung), persepsi subjektif (*thermal comfort* dan *thermal sensation*), serta performa kognitif (*Dexterity Test*, *Stroop Test* dan, *Manual Counting Task*).

Hasil penelitian menunjukkan bahwa konsumsi minuman hangat, baik air maupun jahe, secara signifikan membantu menstabilkan suhu timpani ($p = 0,005$). Partisipan melaporkan peningkatan sensasi termal dan kenyamanan termal secara signifikan dibandingkan kondisi tanpa konsumsi minuman (CONT). Namun, dari aspek kognitif, performa partisipan cenderung stabil dan tidak menunjukkan perbedaan yang signifikan, yang mengindikasikan bahwa fungsi kognitif tetap terjaga selama kondisi eksperimental. Dengan demikian, konsumsi minuman hangat dapat menjadi strategi pemulihan yang efektif bagi pekerja tropis untuk mengurangi dampak paparan dingin ekstrem, terutama dari aspek termal fisiologis dan subjektif.

Kata Kunci : *cold stress*, minuman hangat, minuman jahe hangat, respons fisiologis, kenyamanan termal, performa kognitif

ABSTRACT

Workers exposed to extreme cold in cold storage are at risk of cold stress due to heat loss that exceeds thermal adaptability. Limited adaptation to cold temperatures can exacerbate physiological disorders, thermal discomfort, and cognitive impairment. One practical recovery strategy is the consumption of warm beverages, such as plain or ginger water, to accelerate the heat gain, stabilize body temperature, improve post-cold exposure thermal comfort, and maintain cognitive performance. This study aimed to evaluate the effectiveness of warm beverage consumption as a thermal recovery intervention for workers.

A within-subject experimental design was conducted involving 15 participants (7 males and 8 females). The experiment was conducted in a cold room divided into two rooms: Room A (activity, temperature $-4.58 \pm 1.78^{\circ}\text{C}$) and Room B (rest, temperature $24.23 \pm 0.74^{\circ}\text{C}$). Each participant completed in three cycles, consisting of physical activity (simulated lifting for 10 minutes) followed by rest (10 minutes). Participants were assigned three treatment conditions treatments: no beverage (CONT), warm water beverages (WW), and warm ginger beverages (GW), each with a volume of 200 mL. Measurements were made of physiological parameters (tympanic temperature, skin temperature, heart rate), subjective perceptions (thermal comfort and thermal sensation), and cognitive performance (Dexterity Test, Stroop Test and Manual Counting Task).

The results showed that the consumption of warm drinks, both water and ginger, significantly helped stabilize the tympanic temperature ($p = 0,005$). Subjects also felt a significant increase in warmth and comfort compared to the no-intervention condition. However, in terms of cognition, subjects' performance tended to be stable and showed no statistically significant changes during the exposure, suggesting that cognitive function was still maintained under these experimental conditions. Thus, consumption of warm drinks may be an effective recovery strategy for workers in the tropics to mitigate the impact of exposure to extreme cold temperatures, especially from physiological and subjective aspects.

Keywords: cold stress, warm drink, warm ginger drink, physiological response, thermal comfort, cognitive performance