The Effects of Sex and Menstrual Cycle Phases on Human Temperature Distribution

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Abstract

The paper deals implication of Pennes bio-heat equation by considering the suitable physical and physiological parameters of human body relying on dermal thickness of males and females for temperature distribution on the layers of dermal part. The mathematical model involving bio-heat equation has been solved using finite element method and Crank-Nicolson technique to numerically investigate two dimensional temperature distribution. Initially, human dermal region under consideration is divided into six parts: stratum corneum, stratum germinativum, papillary region, reticular region, fatty layer and muscle part of subcutaneous tissue.

The results delineate tissue temperature distribution during follicular and luteal phases of females. The study is further carried out for the temperature distribution results of these phases as compared to males temperature distribution. The analysis presents that during the luteal phase of females, the tissue temperature is lower as compared to males when atmospheric temperature T_∞ falls below body core temperature. Likewise, females luteal phase temperature is slightly higher as compared to males when T_∞ exceeds body core temperature. But females follicular phase temperature is lower as compared to females luteal phase and males body temperature either T_∞ is greater or less body core. The above differences of females compared to males under same atmospheric conditions may be the causes of females hormonal variation during the menstrual cycle phases.

Keywords: Pennes bio-heat, finite element method,luteal and follicular phase