JASPI
Journal of Antimicrobial Stewardship Practices and Infectious diseases
December 2023/Volume 1/Issue 1

Editorial

Normal Temperature Range and Fever Definition in Indian Population

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KEYWORDS: Fever; Definition; Body temperature

INTRODUCTION

The definition of normal body temperature and the parameters for identifying fever have long been considered fundamental in healthcare. However, as our understanding of human physiology evolves, it becomes increasingly apparent that the conventional benchmarks might not be universally applicable. This editorial delves into the nuances surrounding normal temperature ranges and the definition of fever, urging a reconsideration in light of emerging scientific insights.

NORMAL TEMPERATURE RANGE

The traditional baseline of 98.6°F (37°C) as normal body temperature has been etched into medical textbooks for generations.[1] However, recent studies suggest this figure may not be a one-size-fits-all standard. Variations in age, sex, and individual factors can influence what should be considered normal. Moreover, climate, geography, and lifestyle must be considered when establishing regional norms. For instance, individuals residing in warmer climates might naturally maintain a slightly higher baseline temperature, challenging the notion of a universal normal range. As we acknowledge the diversity in our global community, a more nuanced approach to defining average temperature becomes imperative.

The older definitions of typical human body temperature were based on axillary temperature in the human body. In a cross-sectional study, Wunderlich

(1868) measured axillary temperatures and defined the normal body temperature as 37°C (98.6°F). Axillary temperatures are not representative of the core body temperature.[2] The older thermometers used were technically not standardised and could have recorded inaccurate readings.

Further studies were conducted by Mackowiak et al. utilizing standardized thermometers.[1] A lower standard oral temperature, that is, 36.8°C (98.2°F) rather than 37.0°C (98.6°F), was found. Others have also shown that normal body temperatures have decreased now.[3] The suggested mechanisms include low metabolic rates and decreased incidence of infections.[4] Most studies measuring temperature were cross-sectional, which results in bias. Considering 98.6°F (axillary) or 98.2°F (oral) as normal body temperature in the light of newly available evidence would have untoward consequences, and it has been riddling since the inception of modern medicine and needs to be relooked into a new dimension, preferably through a developing society.

Citation: Kapoor M, Panda PK. Normal Temperature Range and Fever Definition in Indian Population. *JASPI.* 2023;1(1):1-3.
DOI: 10.62541/jaspi001

DEFINITION OF FEVER

Fever, often identified as body temperature exceeding 100.4°F (38°C) is a crucial indicator of infection or illness. However, this threshold is not without its challenges. Individuals may exhibit variations in baseline temperatures, and cultural, genetic, and environmental factors can further complicate the fever diagnosis.

The definition of *fever* is an early morning temperature of >37.2°C (>98.9°F) or an evening temperature of >37.7°C (>99.9°F).[5] This definition does not take into account the associated symptoms of fever. This is important because the numerical increase in temperature may be physiological, as during ovulation in the menstrual cycle of females. Studies have also shown higher temperatures in warmer climates and during the warm summer months.[6] Similar variations may be seen with age, gender, and economic development.[4] This suggests that the definition of fever should be tailored to the individual, considering their baseline temperature, symptomatology, and other health factors. Healthcare professionals must adopt a more personalized approach, acknowledging the variability in temperature norms amongst diverse populations.

Advancements in technology have paved the way for more accurate and accessible temperature monitoring. Integrating this technology into healthcare practices can contribute to a more nuanced understanding of normal temperature ranges and quantified fever definition and aid in the early detection of deviations.

This can only be answered through a prospective study that monitors body temperature in a healthy population when afebrile, on follow-up, attaining fever, and in their post-febrile phase.

WHAT IS NEW?

We reviewed three articles on a new, quantitative, and symptomatology-guided definition of fever in Indians by Kapoor and Kumar et al.[7–9]

In their study, they did a longitudinal analysis on healthy participants utilizing a standardized electronic thermometer to determine the mean oral temperature during the non-febrile phase and to determine the diurnal, gender, age-related, and seasonal variations of oral temperature in the same population during non-febrile, febrile, and post-febrile phases on follow-up. One hundred ninety-six participants recorded three temperature readings daily, one after waking up, one between 12 and 3 PM, and one before sleeping, and filled out the symptomatology questionnaire in a thermometry diary. A more stringent temperature recording was done during the febrile phase.

The mean age of the participants was 24.2 ± 5.9 years, and 52% were males. The mean oral temperature of the participants during the non-febrile and post-febrile phases was 98.0°F (standard deviation [SD] 0.61) and 98.01°F (SD 0.60), respectively ($P < 0.001$). The diurnal variability trends revealed the morning, noon, and afternoon mean temperatures to be 97.9°F, 98.1°F, and 98.3°F ($P < 0.001$) during the non-febrile phase. Similar trends were observed in variability among men and women, seasons, and the post-febrile phase. They also did a per-protocol analysis for febrile participants. The mean febrile phase temperature was found to be 100.2 ± 1.4°F. A temperature of 99.1°F demonstrated maximum diagnostic accuracy for feeling feverish (98.2%), along with one (98.3%) or two (99%) associated symptoms. Fatigue (50.3%), warmth (47.3%), headache (47%), malaise / generalized weakness (46.7%), loss of appetite (46.5%), myalgia (45.6%), chills/shivering (44.6%), sweating (43.0%), nausea (42.5%), irritability (38.9%), increased breathing rate (37.1%), and restlessness (36.5%) were the symptoms maximally seen during the febrile phase. Summer and spring months showed higher temperatures (100.4 ± 1.4°F vs. 99.8 ± 1.5°F, p-value < 0.001), whereas no significant temperature difference could be noted amongst the genders.

PUBLIC HEALTH IMPLICATIONS

The implications of redefining normal temperature and fever thresholds extend beyond the clinical setting. Public health campaigns should focus on educating individuals about the variability in temperature norms, emphasizing the importance of personalized healthcare. This shift in perspective could lead to more proactive health monitoring, early intervention, and improved overall well-being.

CONCLUSION

In the era of personalized medicine and technological innovation, it is high time we revisit the conventional norms surrounding oral body temperature. Acknowledging the intricacies of individual differences, environmental influences, and technological advancements can pave the way for a more accurate understanding of what is truly "normal." A symptomatology-correlated definition of *fever* is the need of the hour. Fatigue and feeling warmth were the most common symptoms seen during the febrile phase. Based on the findings of the studies, as mentioned earlier, the revised oral temperature cut-offs to define fever in young Indians should be 99.1°F, along with one

ISSN: 3048-4510 (Online)
DOI: 10.62541/jaspi001

or two associated symptoms. As we navigate this uncharted territory, a collaborative multicentric effort among healthcare professionals, researchers, and the public is essential to redefine this approach to temperature norms and fever definitions, ultimately contributing to a healthier and more informed Indian society.

ACKNOWLEDGEMENT

None

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

None

ETHICS STATEMENT INCLUDING PATIENT CONSENT

Not applicable

AUTHOR'S CONTRIBUTION

Both authors qualified for authorship as per ICMJE criteria. They approved the manuscript.

AI DECLARATION

No AI tool was used to generate research data, perform data analysis, interpret findings, formulate scientific conclusions, or make editorial decisions. All AI-assisted content was critically reviewed, verified, and revised by the authors. The authors take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

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