

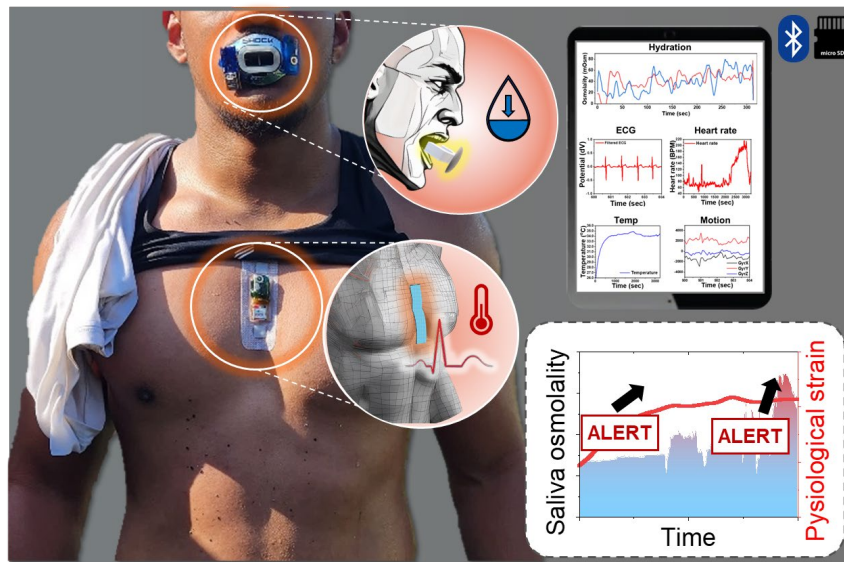
# Smart mouthguard and soft cardiac patch for health monitoring of athletes

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## ABSTRACT

Athletes frequently face risks like dehydration, fatigue, and heart issues due to high-intensity performances. Although there have been advancements in sports science training, a wearable system that can monitor multiple health parameters is crucial to prevent these conditions. Existing commercial wearables, often bulky and limited to single parameter monitoring like heart rate, sweat, or skin hydration, focus mainly on performance. We present a comprehensive, wireless, multi-sensor wearable system incorporating a microfabricated, ultra-thin, flexible sensor. This system, consisting of mouthguards and chest patches, continuously monitors saliva osmolality, skin temperature, and cardiac function. It offers an in-depth understanding of an athlete's hydration level and physiological stress in intense perspiration and heat conditions. The system's effectiveness in tracking physiological changes was proven in field tests, capturing significant increases in dehydration and physical strain during hour-long training sessions. This demonstration showcases the system's ability to detect rapid physiological changes, offering crucial data for mitigating athletic risks and aiding clinical decisions, ultimately improving medical care in sports.



**Keywords:** Athlete health monitoring, wearable electronics, smart mouthguard, chest patch, dehydration, heat strain

## REFERENCES

- [1] Ausland, Å.; Sandberg, E. L.; Jortveit, J.; Seiler, S. "Heart rhythm assessment in elite endurance athletes: A better method?" *Frontiers in Sports and Active Living*. 4 (2022). DOI: 10.3389/fspor.2022.937525.
- [2] McDermott, B. P.; Anderson, S. A.; Armstrong, L. E.; Casa, D. J.; Cheuvront, S. N.; Cooper, L.; Kenney, W. L.; O'Connor, F. G.; Roberts, W. O. "National Athletic Trainers' Association Position Statement: Fluid Replacement for the Physically Active" *Journal of Athletic Training*. 52 (9), 877-895 (2017). DOI: 10.4085/1062-6050-52.9.02.