

The Effect of Far-Infrared Reflective Clothing (FIR) on Heart Activity and Circulatory Efficiency in Athletes

Heba Mostafa Youssef Mohamed

Teaching Assistant, Faculty of Applied Arts, Egyptian Russian University, heba-mostafa@eru.edu.eg

Prof. Dr. Yasser Mohamed Eid

Professor of Clothing Technology, Head of the Ready-Made Garments Department, Faculty of Applied Arts, Helwan University

Prof. Dr. Khaled Mahmoud El-Sheikh

Professor and Head of the Fashion and Clothing Department, Faculty of Applied Arts, Egyptian Russian University, Khaled-elsheikh@eru.edu.eg

Abstract:

This study examines the effect of far-infrared reflective clothing (FIR) on heart rate regulation and blood circulation efficiency during physical activity. FIR technology, enhanced with nano-ceramic particles, was integrated into sportswear to evaluate its impact on cardiovascular performance and overall athletic endurance. Physiological parameters such as heart rate variability, blood oxygen saturation, and peripheral blood flow were assessed during exercise while wearing FIR-based garments compared to conventional sportswear. The results revealed that FIR-integrated clothing optimizes heart rate response, facilitates better blood circulation, and enhances oxygen delivery to muscles, contributing to improved cardiovascular efficiency. The incorporation of nano-ceramic particles within the fabric increases the emission of far-infrared radiation, which aids in reducing cardiac strain, improving thermoregulation, and accelerating muscle recovery post-exercise. These findings highlight the potential of FIR-enhanced sportswear in stabilizing cardiovascular function, minimizing fatigue, and promoting endurance. Further research is encouraged to explore the long-term implications of FIR clothing across different sports disciplines and athletic levels.

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References:

- 1- Ahmed Mahmoud Abdo El-Sheikh: "Textile Materials and Functional Suitability of Multi-Layer Clothing and Their Effect on Comfort," Master's Thesis, Faculty of Applied Arts, Ready-Made Garments Department, 2004.
- 2- Ashraf Mahmoud (Physical Preparation and Warm-Up in Sports Training), Dar Min Al-Muheet ila Al-Khaleej for Publishing and Distribution, 2016.
- 3- Amal Ahmed Ahmed Mahmoud: "The Possibility of Utilizing Polyester Fibers Produced Using Microfiber Technology in the Production of Women's Sportswear," PhD Thesis, Faculty of Agriculture, Department of Home Economics, Zagazig University, 2015.
- 4- Jabbar Rahima Al-Kaabi: "Physiological and Chemical Foundations of Sports Training," Qatar National Press, Doha, 2007.
- 5- Khaled Mahmoud Abdo Abdullah El-Sheikh: "A System for Design and Product Development in the Ready-Made Garments Industry," PhD Thesis, Faculty of Applied Arts, Ready-Made Garments Department, 2010.
- 6- Ghania Filali: "Product Development Methods in the Economic Institution," Master's Thesis, Faculty of Economics and Management Sciences, Mentouri University, 2008.
- 7- Ferial Saeed Ahmed Salloum: "A Study of the Functional Performance Properties of Some Modern Sportswear Fabrics," International Journal of Design, Volume 8, Issue 3, 2018.
- 8- Nadia Ahmed Atallah: "Using the KAATSU Technology in the Production of Sportswear to Improve

- Player Performance," Journal of Heritage and Design, Volume 2, Issue 8, Department of Clothing and Fashion Technology, Faculty of Applied Arts, Benha University, 2022.
- 9- Nashwa Mustafa Hafez: "Using Smart Materials to Enhance the Functional Value of Special-Use Clothing," PhD Thesis, Faculty of Applied Arts, Ready-Made Garments Department, 2005.
 - 10- Walaa Taha Magdy Abdel Hamid: "Using Microfibers in the Production of Single-Layer Sports Warm-Up Clothing," Master's Thesis, Faculty of Applied Arts, Benha University, 2020.
 - 11- Mohamed Eid Hassan, Nadia Abdel Ghafour Al-Andijani, and Sherine Salah El-Din Ali Salem: "Smart Textiles," First Book Publishing and Distribution, 2023.
 - 12- Bontemps B., Gruet M., Vercruyssen F. and Louis J., (2021): "Utilisation of far infrared-emitting garments for optimising performance and recovery in sport: Real potential or new fad" national library in medicine.
 - 13- Devanand Uttamk,(2013): " Active sportswear fabrics" International journal of IT, Engineering and Applied sciences research.
 - 14- Faheem Ahmd, Bushra Mushtaq, Abher Rasheed, Sheraz Ahmad, Farooq Azam (2023): "Recent Developments in Materials and Manufacturing Techniques Used for Sports Textiles" Review Article, School of Engineering and Technology, Pakistan.
 - 15- Hayes S., Venkatraman P., (2016): "MATERIALS AND TECHNOLOGY FOR SPORTSWEAR AND PERFORMANCE APPAREL" Taylor & Francis Group.
 - 16- Hill R. (2016):" Fibers & Fabrics in Sports", Textiles, Vol. 14, No.2, 30-36
 - 17- Vatansever F. and, Hamblin M. R., (2012): "Far infrared radiation (FIR): its biological effects and medical applications", National library in medicine, Boston, MA, USA.
 - 18- Mu Y., Jin Z., Yan Y. and Tao J., (2022): "Effect of far-infrared fabrics on proliferation and invasion of breast cancer cells "International Journal of Clothing Science and Technology ,China.
 - 19- Nakajima T., Hachi no Y. and Yamano H., (2002): " Effect of thermal radiation from fabrics on human body" International Journal of Clothing Science and Technology, Tokyo, Japan.
 - 20- McCall W. V., Litton A., Lundeen J., Francisco J. and Case D., (2018): "The effect of far-infrared emitting sheets on sleep" Health Sciences Department, Laboratory of Experimental Neurosciences – University of Southern Santa Catarina, Palooka, Brazil.
 - 21- Jay T., Skolnik E. R., and Stefanishyna D. J., (2015): "Apparel with Far Infrared Radiation for Decreasing an Athlete's Oxygen Consumption during Submaximal Exercise" Human Performance Lab, Faculty of Kinesiology, University of Calgary, Canada.
 - 22- Syduzzaman M., Patwary S., Farhana K., and Ahmed S., (2015): "Smart Textiles and Nano-Technology: A General Overview" Article in Journal of Textile Science & Engineering.
 - 23- Leung TK., Lee CM., Tsai SY., Chen YC. and Chao JS., (2011): "A pilot study of ceramic powder far-infrared ray irradiation (cFIR) on physiology", national library in medicine, China.
 - 24- -----(2022): "Far Infrared Fabric / Thermal Fabric", available at: <https://www.sportingtex.com/far-infrared-radiation-fabric> accessed on: 10/2024
 - 25- Manash Jyoti Deka, (2017): "Tea-Carbon Dots-Reduced Graphene Oxide: An Efficient Conducting Coating Material for Fabrication of an E-Textile", available at : <https://pubs.acs.org/action/showCitFormats?doi=10.1021%2Facsuschemeng.7b03021&href=/doi/10.1021%2Facsuschemeng.7b03021> , accessed on : 10/2024
 - 26- -----(2022): "Preserving body heat", available at : Preserve body heat: Far Infrared Technology for insulation in textiles (tanatexchemicals.com) , accessed on : 1/2025.

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