

Editors' Conclusion

After reviewing all the chapters that are included in this book and considering the experience in developing research using infrared thermography in sport science, the editor would like to share a final conclusion related to the content of this book.

In general, we can see that there is an increase in interest among researchers for the application of infrared thermography in sport science. This fact is very well exemplified by Fig. 1.11, which shows the number of publications from its beginning in 1975 up to 2015. Furthermore, it can be considered that the most studied application has been the use of infrared thermography in sport medicine, and the assessment of human thermoregulation during exercise. However, although the number of papers is lower in other topics, such as clothing assessment or the application in animal sports (e.g., equestrian sport), it is important not to underestimate these fields of application where infrared thermography can have excellent applicability.

Although infrared thermography is a technique that seems easy to use, it is important to have the essential knowledge before its use. Knowledge about physical principles of infrared thermography, heat transference and thermoregulation are necessary in order to understand the operation of the infrared camera, to avoid and to know methodological issues, to establish logical hypotheses, and to correctly interpret the thermal results. Furthermore, valid measurement in thermography requires following strict methodological steps in order obtain accurate data.

However, more research is needed to determine the adequate procedures for data acquisition and analysis of infrared thermography. One of the most commented upon issues in this book—and it is a special concern for the editor and other infrared thermography users—is the effect of sweat in the estimation of skin temperature. To date, there is not the necessary evidence to determine the effect or error that may be produced by sweat in measuring skin temperature. It is critical to know this effect in order to determine whether we can measure sweaty skin, or whether sweat should be removed before taking any measurements.

Most of the thermoregulatory studies conducted during exercise have been performed using thermal contact sensors such as thermocouples. Differences between infrared thermography and thermal contact sensors are important to take into account before a study, in order to select the most appropriate technique.

Infrared thermography could provide the measurement of large areas without interfering in the heat exchange of the athlete. However, it is not possible to take measurements when the subjects are clothed and the sweat could interfere in the temperature calculation.

On the other hand, there is a large heterogeneity of the skin temperature dynamics in the different studies. There is because skin temperature has a multifactorial dependence and it is influenced by different factors such as the exercise characteristics, the environmental conditions, the other thermoregulatory variables (such as core temperature, sweat rate or blood flow) and the individual characteristics (sex, age, anthropometry and body composition, etc.).

The different chapters of this book showed that there is a large body of evidence for the applicability of infrared thermography in several fields of sport science. Infrared thermography is useful in the monitoring and prevention of injuries in sport medicine. It can provide valuable information for the clothing and equipment design and assessment. In addition, it presents a broad range of applications in equestrian sport as a complementary diagnostic tool in veterinary practice and sport performance.

In other fields, such as foot temperature assessment during exercise or psychophysiology, there is a lack of studies and its current use is minimal. However, the different chapters showed excellently the great potential for infrared thermography in these fields. The applicability of infrared thermography in sport science is constantly evolving and research is currently being performed to assess these potential fields. Clearly, in future editions of this book, these chapters should be updated, showing new evidence, and newly discovered applications.

Although infrared thermography began its use in sport science approximately 40 years ago, we can consider that its use in research laboratories has been extended in recent years, while still a fairly new technique in sport science compared with other instruments such as the electromyography, the photogrammetry or the indirect calorimetry. For this reason, more research is necessary to improve all the research phases: the methodology, the image acquisition, the data analysis, and the interpretation of the results.

Finally, a more effective approach between the laboratory and the field is necessary. Infrared thermography is starting to be used in some high level sport clubs in order to reduce the number of injuries through the daily monitoring of their athletes. However, despite its important benefits in this field, its extension to date is minimal and it is hoped that in the future there will be a higher number of sports clubs and sports associations. On the other hand, other applications are not being used in the field (e.g., psychophysiology). Therefore, it is necessary to establish a real and effective bridge between research and sport centers in order to ensure that all the effort from the research laboratories is being effectively transferred to the field, with the aim of improving performance and reducing injury risk through the use of infrared thermography.

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