TOUR REPORT

Report on participation of the ICMR International Fellow (ICMR-IF) in Training/Research abroad.

1. Name and designation of ICMR- IF: Dr Prasant Kumar Mahapatra, Sr. Principal Scientist

2. Address: Biomedical Applications (BMA) Group

3. Frontline area of research in which training/research was carried out: Health Sciences (Biomedical Applications)

4. Name & address of Professor and host institute:
Prof. Manuel Sillero Quintana,
Polytechnic University of Madrid /Spain
Faculty of Physical Activity and Sports Sciences (INEF)
Professor of the Department of Sports
Calle Martin Fierro, 7.
28040, Madrid, SPAIN
Email: manuel.sillero@upm.es

5. Duration of fellowship with exact date: 01 Month; 1st February – 2nd March, 2023

6. Highlights of work conducted :

i) Technique/expertise acquired :

- Use of T530 Flir camera (A thermographic camera (T530, Flir® Systems, Sweden) with a measurement range from -20 to +120°C, accuracy of 2%, sensitivity ≤ 0.05°C, spectral band of the 7.5 μm to 14 μm infrared, 60 Hz refresh rate, autofocus and 320 x 240 pixels resolution was used to register the skin temperature (Tsk).) for data acquisition /collection
- Data Analysis using Thermohuman software to find the relationship of heat stress on human hand.
- Visit to different laboratory facilities at INEF, UPM and Ministry of Sports, Spain
- Held an online meeting with all partners from Europe for Joint research Proposal
- Delivered a lecture to INEF on the activities of CSIR-CSIO and Biomedical Applications (BMA) Group for further collaboration of mutual interest with other Departments in future

ii) Research results, including any papers, prepared/submitted for publication

- A research paper is being prepared titled (proposed) “Effect of heat stress on human hands – a pilot study” and will be submitted to an SCI Journal
- Protocol prepared (Enclosed as Annexure-I) and data of 33 subjects have been taken during this period.

iii) Proposed utilization of the experience in India:

- Application of thermography for early screening of Musculoskeletal Disorders (Hand & Knee rheumatoid arthritis) and sports science
- A project proposal is being prepared under EU FRAMEWORK PROGRAMME ON R&I ‘HORIZON EUROPE’ CALLS 2023-2024 under Efficient trustworthy AI -making the best of data (AI, Data and Robotics Partnership) titled (proposed) “Detecting signs and grading of severity Index for Rheumatoid Arthritis (Hand & Knee) and monitoring of rehabilitation progress by Infrared Thermography”

Signature of ICMR-IF

ICMR Sanction No. INDO/FRC/452/S-41/2022-23-IHD

Annexure-I

Protocol for data acquisition for Hand

- **Laboratory area:** There should be an adequate size of working space, i.e. at least $2m^2$. So that proper distance (1m) can be maintained between the subject (patient) and camera.
- **Ambient temperature control:** Generally, room temperature is kept at 18-25^oC and should be maintained for at least an hour prior to imaging. The proper humidity level is to be maintained inside the room. Inflammatory lesions are more clearly visualized in a cool environment, typically 20 °C. Examination of the extremities, where the sympathetic nervous system influences the result, warmer ambient temperature of 22–24 °C is generally recommended.
- **Computer and other equipment:** A suitable distance should be maintained between the image processing system and patient to avoid heat disturbance. The camera position should be fixed to capture thermal images of all patient or same patient from the same distance / angle for standardization.
- **Minimum infrared interferences:** Observation room should be properly isolated from external IR radiation. The background should be non-reflective in nature. Lighting condition should be maintained properly but avoid halogen, incandescent, and sunlight.
- **Stabilization time:** Temperature in each plantar sub-region varied as a function of time during the total 25 min of experiment, but equilibrium was reached after 15 min for the overall mean plantar temperature and this was the time recommended for clinical thermographic measurements.
- **Image acquisition tool:** Image data will be captured by FLIR T530
- **IR / Thermal Imaging Set Up**
    a) Prepare the Test Room Condition
    b) Prepare the Subject
    c) Imaging of Affected Joint
    d) Take images of frontal and lateral part of knee

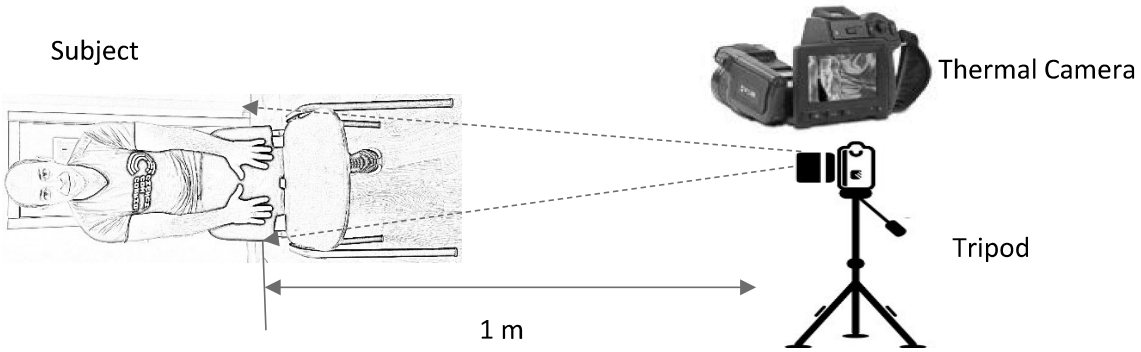

Fig. Acquisition Set up

Digitally signed by Prasant Mahapatra
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Protocol for warming for hands

Heating Pad for Hands

All the subjects will be subjected to heat stress using heating pad with controlled temperature for 5minutes at a temperature of 49.57 ±1.0°C.

Thermographic images of the hands will be acquired at 07 time points,

- at baseline,
- immediately after application of thermal stress
- and then every 1 minutes till 6 minutes then after every 03 minutes until 15 minutes were completed.