RESULTS OF THE SHAPE PROJECT

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EXTENDED ABSTRACT

The overall objective of SHAPE project (Adapted Performance Sportswear) is to develop comfortable and well-fitted sportswear for athletes whose body shapes differ from the average population. Body measurements of professional cyclists and rowers were extracted from 3D scans and compared with average Belgian population. Variation of body measurements and skin-sportswear interface pressure upon rowing and cycling postures was additionally investigated. Significant differences were found between rowers and average Belgian males. Rowing and cycling postures had significant influence on most body measurements and pressure. Fit of prototypes developed based on SHAPE-body sizing charts was positively validated by male rowers. Large number of cyclists critically evaluated their present outfit including fit and comfort. Two prototypes were designed according to individual needs of G-sport cyclists and their functionality, comfort and fit were positively evaluated.

Key Words: anthropometry, elite athletes, sportswear, fit, comfort

1. INTRODUCTION

Sportswear shall ensure great freedom of movement, perfect fit and comfort regardless of any sport-specific movements. They shall therefore consider sport posture and especially body proportions and shape of professional athletes who due to large training volume differ significantly from the average population. Several international studies [1-7] reported deviation of rowers anthropometry from average population. Posture was investigated in relationship with garment or workwear fit [8-17] but there is a lack of studies linking garment patterning and body changes upon sport-specific posture [14]. The main objective of the SHAPE project was to develop comfortable and well-fitted sportswear for elite athletes. It therefore assessed their needs (i.e., rowers, cyclists, G-sport cyclists), body proportions and their variation with sport postures. It developed a methodology to generate specific size tables and garment patterns and produced prototypes validated virtually and by test persons.

2. MATERIALS AND METHODS

2.1 Requirements and anthropometry of the target groups

The needs of rowers and G-sport cyclists with respect of sportwear fit, materials, design and comfort were assessed by interviews and an on-line survey was used to get insights into cyclists' preferences concerning sportwear brands/comfort/fit and most frequent injuries. A number of n=20 body measurements were extracted (ISO 8559) for n=54/ 20 elite lightweight and heavy weight male/female rowers and n=14 cyclists, age 18-35 years. The target group was scanned by 3D body scanners with structured light (i.e., Symcad and TC2). The influence of two cycling

postures (i.e., knee up/down) and rowing postures (i.e., catch/ finish) on body measurements and skin-sportswear interface pressure was quantified for a dataset of n=11 male cyclists and n=54/20 male/ female rowers respectively. Therefore five body measurements (i.e., upper-arm/thigh/knee girth, back length and width were assessed manually by a measurement tape and a PicoPress instrument was used to assess the skin-sportswear interface pressure at two body locations (i.e., upper-arm and thigh) in static and two dynamic postures.

2.2 Body size charts, prototypes development and evaluation

Elastic knitted fabrics for sportwear (i.e. PES/EL, PA/EL) were collected from the industrial partners of the project and physical tests were carried out among which air permeability (ISO 9237: 1995) and its variation upon biaxial stretch and domestic washing; water vapor permeability (ISO 15496:2015); moisture management (AATCC 195:2011); drying time (ISO 17617:2014) of acid/alkaline artificial sweat, etc. Body sizing charts and related SHAPE prototypes were developed for elite male rowers in two garment sizes (i.e., 52 and 58). Similarly two SHAPE-P prototypes were developed considering posture and their fit was assessed virtually and by rowers against prototypes SHAPE and SMARTFIT (i.e., sizing tables of average Belgian male). Prototypes were developed for two hand bikers based on their specific functional needs and size. A field test protocol was set up and fit, design, functionally and thermophysiological comfort of the G-cycling sportswear were qualitatively evaluated.

3. RESULTS AND CONCLUSIONS

About n=90 cyclists critically assess their current sportwear (i.e., comfort, fit, preferred brands) and low back pain was identified as most prevalent injury. Suggestions of hand bikers and rowers were considered in selection of materials and development of prototypes. Twenty-two body measurements of n=83 Belgian males, average age 24±4 y (SMARTFIT project) and n=35 heavy weight male rowers, average age 21±2.5 y were compared and 13 statistically significant differences ($p<0.05$) were found among which chest girth and stature (rowers > 4 cm larger than Belgian males). Length of chest, back and legs was also significantly larger (up to 4 cm) for the rowers, similarly to several body girths among which waist, upper-arm, thigh and knee. Fit of SHAPE prototypes based on these body measurements was positively evaluated by rowers as compared with SMARTFIT-prototypes. Rowing posture led to large influence on pressure (max. 55%) and anthropometrics (16%) for male and up to 82% versus 13% for female rowers respectively. However, the maximum absolute values of 10 mmHg pressure indicate no pressure discomfort for the sportswear considered. Back length and width were most affected by posture, and increased especially from static to catch position by 12% (6.1 cm) and 16% (6.5 cm) for male rowers, and respectively by 11% (4.9 cm) and 13% (4.7 cm) for female rowers. Most of the variables investigated showed statistically significant changes upon rowing posture, catch in particular. Nevertheless, rowers found SHAPE-P prototypes generally too large suggesting that no extra ease was necessary for the considered knits with 20-30 % spandex. The hand-bikers prototypes combining materials with various moisture management capability according to sweat-pattern of each test person were better evaluated as compared with reference (i.e., own cycling suit) in terms of fit, functionality and thermophysiological comfort.

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