

The 5Ps Model to Optimize Compression Athletic Wear Comfort in Sports

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Abstract: Engineered design of compression athletic wear has been selectively applied in various recognized Olympic sports and popular recreational activities. This recent development is, as one type of additional body-behavioural support, protection and adjustment, plays a crucial role, in improving the athletes' performances. Typically, this is accomplished by providing engineered design support, pressure, and form-fit on targeted areas of athletes' body. In the present paper, a contextual model including 5Ps (i.e. Physical, Psychological, Physiological, Psychophysical, and Psychophysiological properties) related to user comfort and performance, has been developed to analyze multiple relationships between the athlete, athletic wear, immediate body space and sports environment, which would help us understand the effects of athletic wear on sports performance. The 5Ps reference model explores the mechanisms of action of body-clothing-environment system from a comprehensive view, thus effectively optimizing functional design of compression athletic wear in practice to enhance sports achievement and comfort.

Keywords: 5Ps model, compression, athletic wear, comfort, sports.

1. Introduction

Growing interest in sports activities and the emergence of new Olympic sports has stimulated and increased the consumption and demanding expectations for athletic wear [1]. Sport is an integral part of every culture and has profound impact on the athlete, national pride, the spectator, and the media. In the United States, participants in running/jogging and treadmill sports increased by 30.8% and 34.3% in 2007 compared to 2000 [2]. Exercise walking is a most popular sport, which has showed a marked ascent since 1993, and team exercise (e.g. basketball, baseball, football, etc.) continues to attract sports participants (Figure 1). Scientific design and development of athletic wear with wearing comfort and satisfactory functionality enhance not only the well-being and health of the athletes, but also their sports performance and records achievement. Engineered design compression athletic wear (CAW) has been selectively applied in various recognized Olympic sports and popular recreational activities, e.g. running, bicycle riding, skating, swimming, gymnastics, rock climbing, football, yoga, etc. The application of CAW has played a crucial part in improving the athletes' performances in speed, body control, stamina, strength and fatigue recovery, etc., by providing engineered design support, pressure and form-fit on targeted areas of the athletics' body [3-4].

Compression athletic wear are usually designed to

intimately maintain contact with human skin. The functional performance of athletic wear is largely determined by complex interactions between multiple factors, such as material physical structure and mechanical properties, thermal and moisture regulatory properties, the size and shape of the body to which it is applied, the corresponding dimensions of designed athletic wear, the nature and levels of physical activity undertaken by the athletes, comfort, and sports environment, etc. The comfort status is a subjective perception and judgment of a wearer on the basis of integration of all of these above factors, which has been generally defined as range of physiological, psychological and physical variables and their interactions with environment [5-7]. Most of the competition sports proceed in dynamic states, during which the athlete's body, mental activity, clothing, and near environment generate more complicated interaction and continuous variation. For instance, during intensive training, an athlete's clothing moisture transport ranges from 1.5 to 2.5 litres per hour [8]. In cycling sport, the athletes' metabolic heat increases 6 times and perspiration 14 times more than those engaged in normal routine indoor activity [9]. Hence, the psychological responses of athlete towards the changed physical properties of athletic wear (i.e. psychophysical mechanism) and the physiological activities with the variations of psychological processes (psychophysiological mechanisms) may exert more prominent influence on the overall comfort

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perception of athletes. In the present study, we seek to develop a contextual model that includes the 5Ps, i.e. Physical, Psychological, Physiological, Psychophysical, and Psychophysiological properties related to user comfort, and to present the relationships between the athlete, athletic wear, immediate body space, sports environment, and competition culture. Based on the engineered design athletic wear, how to optimize wearing comfort related to 5Ps are further discussed.

2. 5Ps Contextual Model for Optimized Performance User Comfort

The developed model as shown in Figure 2 illustrates the factors involved in the multiple layers which are influencing and determining the user comfort.

The multiple layers deal with the following issues:

- An inner layer of engineered static aesthetic design and basic functional properties of athletic wear (i.e. style, colour, dimensions, attributes, panels design, fit, etc.);
- A design layer focused on dynamic functional performance and wearing behaviour, which are related to the condition of athletes, behavior of clothing, and their interaction with the performing athlete, etc.;
- The 5Ps Core properties layer further depicts the dynamic interactions between athlete, clothing system, and their integrative action towards performance and user comfort. It should be noted that two interactions occupy a single sector of the 5Ps in Figure 2, i.e. Psychophysiological and Physiological psychology. Both of these interactions depict the mind-body interactions and in this paper are regarded as one of the 5Ps;
- The outer layer depicts the related sports condition and environment (e.g. life profile, immediate body space, competition environment, and competition culture, etc);
- The subjective and objective evaluation methods that are correspondingly applied in analysis of 5Ps properties to determine comfort perception as shown in Figure 2. This layer illustrates that a complete evaluation of optimized performance and comfort must take into account both subjective and objective evaluation and these are often interconnected as in the psychophysical and psychophysiological sectors;
- Optimizing 5Ps properties and factors of multiple layers to achieve optimized performance and user comfort is the essential target of the proposed contextual model.

The developed model comprehensively reflects multiple mechanisms, multiple states, and multiple properties influencing an athlete's performance and wearing comfort. Rational consideration and integrative engineered design based on the 5Ps contextual model will help to optimize the functions, performance, and comfort of compression athletic wear and other related sports textiles.

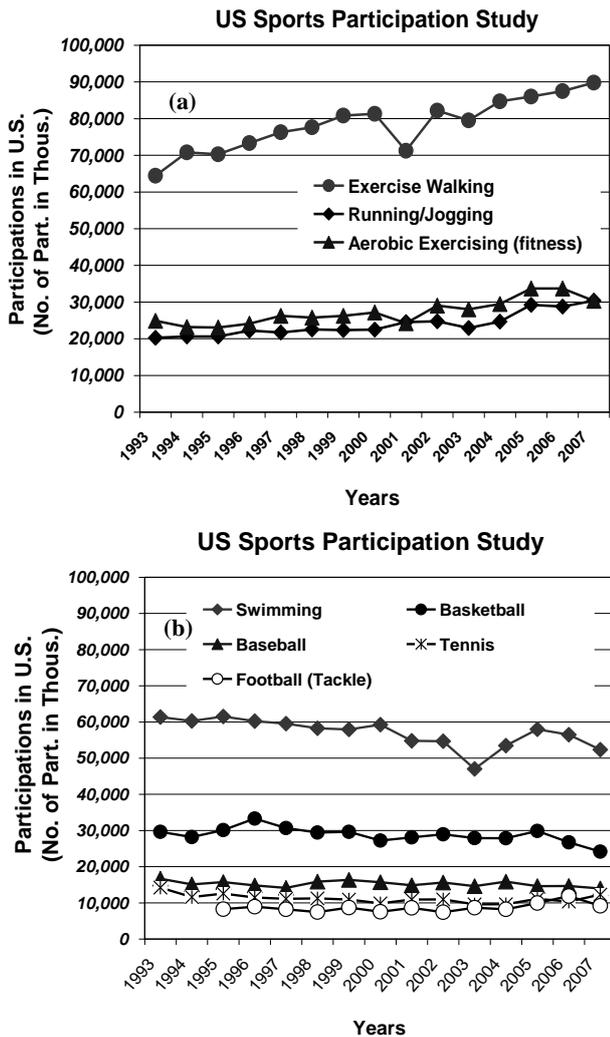


Figure 1 Trends in selected sports participation analyzed over 15-year period in the United States