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Wool and cotton blends for the high-end apparel sector

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Abstract

Branded blends of wool and cotton for high-end apparel fabrics were established in Britain and later exported to many English-speaking countries during the 19th century (e.g. woven fabrics Viyella™, 55% wool, 45% cotton; Clydella™, 81% cotton, 19% wool). During the late 20th century, cotton and wool blend yarns for high-end apparel applications were developed in Australia (Colana®, 70% cotton, 30% wool). None of these branded blends of wool and cotton has a current market presence, yet there is evidence of relevance and interest in such blends for the high-end apparel market. How can we account for this disappearance and for the renewed interest?

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Keywords: cotton, wool, natural fibre blends, apparel, next-to-skin

1. Introduction

Protein fibres for high-end applications include wool, particularly in human health and well-being [1], cashmere, and silk. However, world demand over the period 1982-2015 for wool fibre decreased (1.62 to 1.16 million tons respectively), for silk fibres increased slightly (0.06 to 0.18 million tons respectively), while demand for all fibres increased (13.10 to 64.63 million tons respectively) [2]. (Data on cashmere is not included in these world summaries.)

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Demand for synthetic fibres accounts for most of the total fibre increase [2], but cotton, also widely
used increased during the same period (14.71 to 23.60 million tons respectively). What is unclear in these data is the percentage/volume end use of the different fibre types: what volumes are used in industrial, medical, agricultural, geotextiles, technical, apparel? We do know there is continuing interest in natural fibres such as wool and cotton for the high-end apparel market. One question then is what benefits accrue for the high-end next-to-skin product market by blending wool with cotton? The present paper seeks to account for the re-emergent interest in those blends, and known or perceived advantages. The three key issues are: 1 human physiological benefits, 2 environmental implications, 3 culture-bound preferences for fibre types.

2. Key issues

2.1. Human physiological benefits

2.1.1. Overview

Evidence of effects of apparel systems on human performance and physiology has strengthened since the 1980s, in workplaces, in sport, and in health [3, 4]. Properties of fabrics from which these systems are made, at least for high-end next-to-skin products, are those related to heat and vapour transfer; moisture absorption and perception of dampness; tactile properties; development, retention and release of human body odour. Blends of wool and cotton exhibiting many desirable attributes were available during the early 20th century (e.g. Viyella™, Clydella™) and again at the end of the 20th century (e.g. Colana®). These properties were neither well-understood at that time, nor did effects of the fabrics in garment form on human responses attract much attention, notwithstanding high visibility in national sporting applications (e.g. in Olympic Games [5] and in international cricket [6]. Some general disadvantages were apparent; wool fabrics with rather poor resistance to abrasion, cotton fabrics with rather poor resistance to creasing.

2.1.2. Heat and vapour transfer

Heat and vapour transfer are important properties for next-to-skin textiles as they have a major effect on wearer perceptions of acceptability. Common physiological indicators include heart rate, core temperature, skin temperature at various body sites, sweat output/rate, change in body mass, and humidity at the skin surface: specific and general perceptions are useful additional indicators. Few human trials investigating blends of wool and cotton have been identified, although trials comparing effects of both wool and cotton (and other) fibres have been published.

The perception of temperature change resulting from the heat of sorption with wool fabrics has been examined through wear trials. Stuart et al [7] compared mittens of 100% acrylic (low heat of sorption) and 100% wool (high heat of sorption), and concluded the temperature change caused by heat of sorption was perceptible: dry 100% wool mittens were warmer than both 100% acrylic and 100% wool mittens that had been conditioned to 80% relative humidity. In another study, effects on thermal performance during wind assault showed cotton/wool blends were superior to matched fabrics of 100% cotton and of 100% polyester, although no perceptual differences were observed [8]. The authors speculated that evaporative heat loss from the cotton/wool blend was greatest because of reduced thermal insulation after moisture from the microclimate had been absorbed, given the hygroscopicity of both cotton and wool. Vokac et al [9] compared vests of double cotton, polypropylene and cotton, and polypropylene as part of a layered assembly. A lower skin temperature was observed with the double cotton compared to double polypropylene: as structures were not matched, results are likely to be confounded. Participants could not detect differences between the cotton and polypropylene items notwithstanding the lower skin temperature under cotton. Next-to-skin garments constructed from 100% cotton have been reported to retain lower garment microclimate temperatures than those made from polyester [10]. Polyester worn over the skin has been shown to result in skin with higher relative humidity than fabrics made from cotton and linen. Five fabrics manufactured as protective overalls (67% polyester, 33% cotton; 100% oven dried wool; 100% aramid; 100% wool; 100% cotton) were evaluated to establish whether or not physiological effects could be identified [11, 12]. Differences in temperature and in humidity (instrumental, sensory) were non-significant. Similarly, in a study on temperature change inside sock/shoe assemblies no significant changes in temperature with any sock were detected (100%