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Sweat management strategies in sportswear in Zimbabwe: A case study of Bulawayo

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ABSTRACT

The wide spread accessibility of information enhances knowledge about sports and sweat management strategies thus creating awareness to athlete's need for comfort of their garments in Zimbabwe. In the quest to improve the comfort of athletes' sportswear, new fibres, spinning, weaving or knitting parameters, fabric density, thickness and weight; coloration, finish, garment fit and make-up techniques are emerging to satisfy the comfort expectations by athletes. This paper discusses efforts made to assess the need for sportswear comfort for athletes in Bulawayo, Zimbabwe. The exploratory case study, adopted quantitative paradigm and employed questionnaires as primary data collection tools. A purposive sample resulted in identifying three objects of study, viz, Company X, athletes, and sports scientist. Methods used in this research are Sweat Management Tests to characterize fabric Sweat Management Properties: Wicking Test, Drop Tests, Drying Time and Diffusion Ability. Performance of local sportswear manufactured by Company X was compared to Company Y, an international reputable sportswear manufacturer who implements highly rated sweat management strategies. Results showed local sportswear had inadequate sweat management strategies; thus there is need to increase moisture absorption properties and maintain optimum heat / temperature control in sports fabrics in Zimbabwe.

Key Words: athletes, sweat management, performance, comfort, fabric, and sportswear.

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1. INTRODUCTION

The term sweat management is often used as an advertising slogan (Petry, 2008). In general, sweat management is understood to be the ability of a textile fabric to absorb gaseous or liquid humidity from the skin, to transport it from the inside of a textile to the outer surface and to release it into the surrounding air (Petry, 2008). Sweat management can be defined as the controlled movement of water vapour and perspiration from the surface of the skin to the atmosphere through the fabric (Chinta, Pooja and Gujar, 2013a & 2013b). Sweat management is one of the key performance criteria in today's apparel industry which decides the comfort level of sportswear fabric (Chinta, Pooja and Gujar, 2013b).

1.1 Sweat Management

Sportswear design should allow the maintenance of body temperature under a widespread range of environmental conditions and body activity. Sportswear should not inhibit the evaporation of humidity caused by sweat, and thus, not interfering with the temperature regulation of the body. Sweat impermeable materials are not merely unpleasant, but, also reduce the performance of the wearer; hence the need for effective athletes' sweat management strategies. Athletes should be comfortable if they are to fully focus on their sporting activity.

Convection, conduction, radiation and evaporation are the four processes in which

heat can be lost from a human body. The human body generates metabolic heat during sporting activities and evaporation becomes the main avenue of heat loss. The evaporation involves the loss of heat through the conversion of water to gas through the evaporation of sweat. Sweat is produced as a part of the natural mechanism to release excess heat from the body. A naked human body experiences heat loss almost immediately as sweat is rapidly evaporated from the skin during sporting period. Sportswear may act as a barrier to sweat and heat loss. Sweat management is the key function of fabrics designed for use as sportswear if over-heating is to be avoided. The insulation properties of a sportswear fabric usually decline when wet with sweat, resulting in rapid heat loss from the wearer (Anbumani and Babu, 2008). A wet fabric can relieve in the cooling of hot skin during sporting activity. Nevertheless, once the activity and excessive heat production stop, the heat loss process should be restricted. A wet body cools promptly leading to post-exercise "chill" (Anbumani and Babu, 2008).

Sportswear should essentially feel soft, be flexible, and not cause irritation of the skin such as itching or scratching. Again, the sportswear should not stick to the skin even when the skin is wet with sweat. Excessive moisture adds weight to the fabric and increases chances of skin diseases. There are three important properties which should characterise sportswear worn next to the skin. The primary property is to wick sweat away from the skin surface as fast as possible. Secondly, to evaporate sweat as quickly as possible and make athletes feel comfortable. Finally, to make skin feel dry since sportswear with a humid feel are unpleasant to wear.

Some positive attributes that characterise good sweat management fabric are as follows (Chinta, Pooja and Gujar, 2013a & Sanjay et al, 2002):

i. Optimum heat and moisture regulation – the ability to control humidity so as to manage the body temperature.
ii. Good air and water vapour permeability - the state of being penetrable.
iii. Rapid moisture absorption and conveyance capacity – the ability to wick sweat from the body and evaporate the sweat.
iv. Absence of dampness – the absence of wetness.
v. Rapid drying to prevent catching cold.
vi. Low water absorption of the layer of clothing just positioned to the skin.
vii. Dimensionally stable even when wet – the control of fabric weight.
viii. Durable – the permanence and strength of fabrics.
ix. Easy care performance – the ability to return to original state after laundry.
x. Lightweight.
xi. Soft and pleasant touch – flexible.
xii. Breathability and comfort – the ease with which sweat passes through the fabric.

No single fibre or blend of different fibres can produce an ideal sportswear. Blending of fibres does not give the same effect as that of multi-layer fabric (Sanjay et al, 2002). Ideas differ among textile manufacturers as to how to achieve an optimized sweat management fabric. To bring about different effects, a suitable fibre material is used or a subsequent finishing is applied. A suitable sportswear may be produced by combining specialized fibres and finishes. The most important features to consider in an attempt to achieve the above positive attributes are fibre type, weave (or knit or non-weave or layered) construction, weight or thickness of the material and the presence of chemical treatments (Sanjay et al, 2002). These important features come under one umbrella term, called **'sweat management strategies'.**

2. RESEARCH METHODOLOGY

Purposive sampling method was used for this research since the group participants were chosen according to predetermined criteria relevant to address the desired research questions. The research study focused on Company X sportswear since it is one of the highly regarded sportswear manufacturers in Zimbabwe. Secondly, basketball players from one of the Bulawayo League teams since it was the most accessible team that wore Company X manufactured uniforms. All final year students from the Department of Sports Science, National University of Science and Technology were also selected. Structured questionnaires were used to collect data from all participants.

Moisture Management tests are experimental methods used to characterize sweat management properties of sportswear (Junyan et al, 2005). Two polyester interlock knitted sportswear fabrics were selected to compare and contrast sweat management properties. The first fabric is manufactured by a local sportswear manufacturer, Company X; and the second fabric by Company Y, an international sportswear manufacturer. The samples were tested for sweat management properties; drying time, diffusion ability, drop test and wicking test.

3. RESULTS

Data findings are presented, analysed and interpreted as they relate to the implementation of sweat management strategies. Further, analysis of findings was made leading to concluding the extent to which sportswear manufactured in Zimbabwe meets customer value and expectations.

3.1 Analysis of Questionnaires

Data showed that local sportswear was breathable, durable, has the ability to go back to original state after laundry and moderately sweat permeable. However, local sportswear does not have good water / windproof and warmth properties. This indicates that sportswear manufactured in Zimbabwe is comfortable when playing sports on a sunny day because of its breathable properties, but does not provide the needed protection against other weather conditions such as windy and rainy conditions, Figure 1.

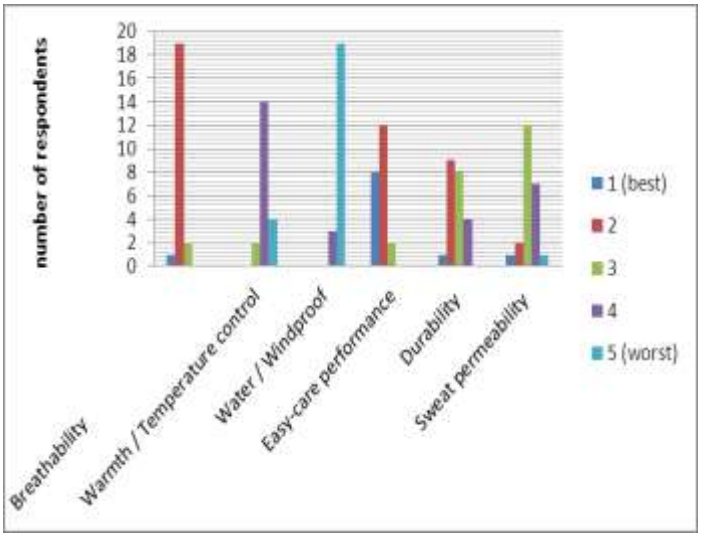

Figure 1: Performance of Local Sportswear

3.2 Analysis of Sweat Management Tests

Analysis of sweat management tests comprised three tests, viz, Drying Time**,** Drop Test and Diffusion Ability, and Vertical Wicking,

- **Drying Time**

  Tests were performed at the Department of Textile Technology Laboratory consistent with standard ISO 9237 and AATCC 199-2011. Sportswear should absorb large amounts of perspiration, draw moisture to the outer surface and keep the body dry. The drying time is dependent mainly on how much water is absorbed by the fabric, implying fabric thickness.

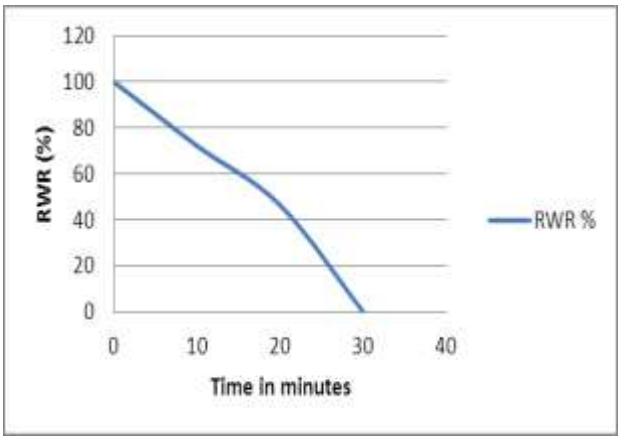

Figure 2a: Drying Time for Company Y Fabric

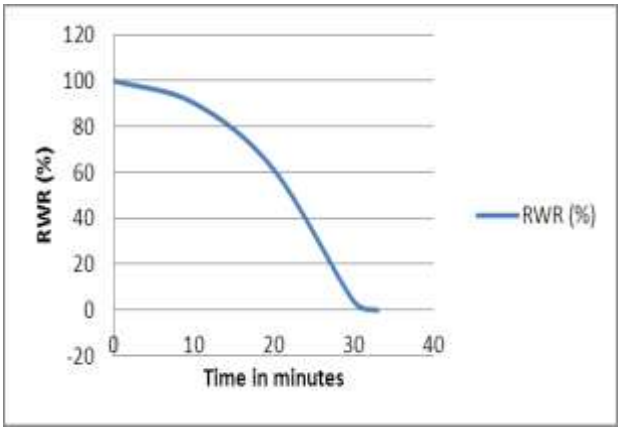

Figure 2b: Drying Time for Company X Fabric

KEY: RWR- remaining water ratio.

The evaporation curves presented in Figure 2 demonstrate that the drying rates of Company Y fabrics are slightly higher and the drying times lower than those of Company X fabrics.

- **Drop Test And Diffusion Ability**

  The time required for the specular reflection of the water drop to disappear was measured and recorded as water absorbency time. The water absorbance time for Company X fabric was 0.723 seconds and that of Company Y fabric 0.444 seconds. The low water absorbency time of Company Y fabrics is due to its effective sweat management strategies which allow the fabric to absorb sweat instantly.

  Diffusion ability expresses the rate of water diffusing in the fabric surface and represents the fabric's instantaneous water (perspiration) absorbency and transferring ability (Onofrei, Rocha and Catarino, 2011). The diffusion ability of Company Y fabrics (56cm^2) is higher than the Company X fabrics (45.5cm^2). This behaviour is related to yarn characteristics, in particular fibre morphology and nature (hydrophilic or hydrophobic character), and to a certain extent, with the fabric characteristics and structure. The most influential factor of diffusion ability in Company X fabrics is the hydrophobic character of the polyester based fibres. In Company Y fabrics, the hydrophilic character of the cellulose-based finishes is the most influencing factor of diffusion ability (Rushall and Pyke, 1990).

- **Vertical Wicking Test**

  Sportswear should absorb large amounts of perspiration, draw moisture to the outer surface and keep the body dry. In order to optimize absorbency functionalities in sport clothing and support moisture management claims, it is necessary to determine the wicking behaviour of sportswear (Rushall and Pyke, 1990). Vertical wicking test results are shown in Table 1. The difference between the height achieved by water in the two fabrics is small (1,5cm). This shows that the ability of the two fabrics to move sweat away from the skin to the outer surface is nearly the same. There was a notable difference in the amount of water absorbed by each fabric. This was interpreted from the

weight of the plate with water before the wicking test and after removing the fabric. The results showed that the weight of the plate with water was 7,77g and after wicking test of the Company Y fabric the weight reduced to 5,37g and after wicking test of the Company X fabric the weight was 6,60g. Results indicated that some sweat management strategies were used on Company Y fabric allowing the fabric to absorb large amounts of water, above that of normal polyester used by Company X.

Table 1: Vertical Wicking Test Results

Company Y		Company X	
Water absorption, cm	Time, (seconds)	Water absorption, cm	Time, (seconds)
15	30	13,5	30
20	60	20	60

4. CONCLUSION

The general objective of this research was to investigate the significance and propensity of local sportswear to manage sweat and enhance athletes' performance. The results showed that local sports wear lags behind compared to international sportswear such as Company Y. There is still scope for effective sweat management strategies to be implemented in for local sports wear if athletes' performance is to be improved in Zimbabwe.

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