Comparison of Odor Intensity between Nylon and Polyester

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Despite the versatility of polyester fiber in sportswear, its low moisture regain (0.4% at 65% R.H. 20°C) as compared to natural fibers, considerably affects the intensity of body odor emanating from clothing following wear. Previous studies, that found polyester to be more odorous than cotton and wool, attributed this to its hydrophobic nature (McQueen et al., 2008; Munk et al., 2001). Long-chain fatty acids found in apocrine sweat are likely more readily absorbed and retained by a hydrophobic fiber such as polyester, which serves as a precursor for bacterial metabolism and thus odor (McQueen et al., 2008). Wool and cotton were found to have less apparent difference in odor intensity as they retain fewer non-polar oily soils (McQueen et al., 2008) as it is with fibers with a regain above 4% (Bowers & Chantrey, 1969). Nylon, another common synthetic fiber and also used in sportswear, has a regain of 4.5% (65% R.H. 20 °C), and therefore may be less odorous following wear than polyester due to its more hydrophilic nature. There has been anecdotal evidence that odor emanating from nylon fabrics may be less intense than polyester, however, no empirical evidence exists in the research literature. Therefore, the purpose of this study was to compare fabrics made from nylon and polyester fibers in odor intensity following wear against the underarm.

Methods: Two nylon and two polyester fabrics were paired together as being 'similar' in fabric structure. Test fabrics were purchased from Testfabric Inc and shown in Table 1.

Table 1. Description of test fabrics

		Fabric description	Mass per unit area (g/m^2)	Testfabric code #
Pair 1	nylon [N1]	texturized nylon 6.6, double knit	260	314
	polyester [P1]	texturized polyester, double knit heat set	206	720H
Pair 2	nylon [N2]	nylon 6.6 spun yarn, plain weave	190	365
	polyester [P2]	spun polyester type 54, plain weave	171	755

Matched fabric pair swatches were sewn in the underarm area of cotton t-shirts so that each fabric in the pair was exposed to the same odor conditions. Eight healthy participants who had been screened for odor intensity wore the t-shirts and provided sweat samples by either exercising for at least one hour (Participants M1, M2, F3, M4) or for 12 hours without exercising (Participants F5, M6, F7, F8). After wear fabrics were cut into smaller fabric specimens (18 mm x 18 mm) and pooled together in groups of 16 to create test samples. Following cutting, fabric specimens were frozen for one week, to prevent further degradation to the odor, before sensory analysis was conducted. Freezing body odor samples have been shown to not alter odor quality significantly (Lenochova, Roberts, & Havlicek, 2009). On the day of the sensory panel, were placed in 60 mL wide-mouth bottles for sensory analysis. The test samples were presented, following a Latin square design, to a trained sensory panel (n=15) who rated odor intensity on a 150 mm line scale labeled 'extremely low' on the left hand side and 'extremely high' on the right hand side of the scale. Each fabric pair for each participant was analyzed using paired-sample t-tests using SPSS software.

Results: Figure 1a shows the results for Pair 1 fabrics and Figure 1b for Pair 2 fabrics. No consistent trends were apparent, with neither fabric being consistently lower in odor intensity than the other fabric. In fact, fabrics were perceived to be not significantly different for the majority of the participants. When significant differences between the fabric pairs were detected nylon was more often perceived to be significantly higher in odor intensity than polyester (e.g., Participant F5, Pair 1: $t_{14} = 2.374$, $p < 0.05$). Only for one participant was polyester rated as significantly higher than nylon (Participant 1, Pair 2: $t_{14}=-2.952$, $p<0.05$).

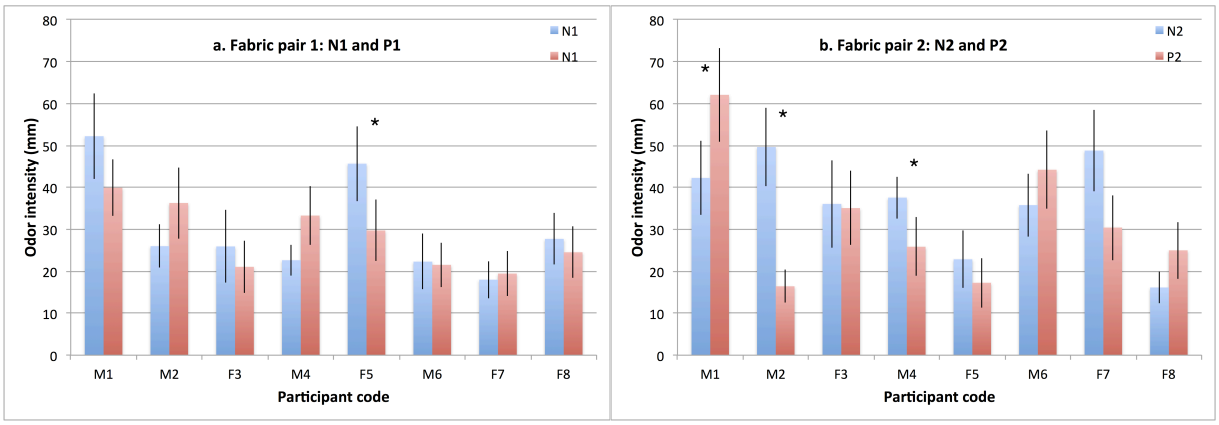

Figure 1. Mean (±SME) of odor intensity for matched fabric pairs (denotes significant differences at p<0.05)*

Discussion: These findings were unexpected given the previous research that showed fabrics made from hydrophilic fibers are generally less odorous than hydrophobic fibers such as polyester (McQueen et al., 2008). In comparing wool or cotton with nylon, nylon would be expected to be more odorous, but when comparing to polyester it was expected to be less odorous. One explanation for the lack of differences found in this study could be due to the weight of the fabrics. Although the fabrics were selected to match as closely as possible, the nylon fabrics were heavier than polyester in both fabric pairs. This may result in more fiber surface area for adsorption of odorous compounds. In the case where nylon fabric was significantly less odorous than polyester this could relate to a left/right odor imbalance present in the participant. More research is recommended to investigate more similarly matched fabric pairs in terms of fabric weight. As well as, carry out repeat wears where wearing and washing may result in differences in accumulation of odor over time.

References:

Bowers, C. A., & Chantrey, G. (2016). Factors controlling the soiling of white polyester cotton fabrics. *Textile Research Journal*, *39*(1), 1–11.

Lenochova, P., Roberts, S. C., & Havlicek, J. (2009). Methods of human body odor sampling: the effect of freezing. *Chemical Senses*, *34*(2), 127–38.

McQueen, R. H., Laing, R. M., Delahunty, C. M., Brooks, H. J. L., & Niven, B. E. (2008). Retention of axillary odour on apparel fabrics. *Journal of the Textile Institute*, *99*(6), 515–523.

Munk, S., Johansen, C., Stahnke, L. H., & Adler-Nissen, J. (2001). Microbial survival and odor in laundry. *Journal of Surfactants and Detergents*, *4*(4), 385–394.