Wash it, or wear it? Perceptions of odor control technologies on activewear and their influence on the likelihood to launder

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The consumer use phase contributes to a significant proportion of the overall energy consumption and greenhouse gas emissions in the clothing life cycle (Sohn et al., 2021). Besides visible soiling, odor can be a reason people decide to wash their clothes (McQueen et al., 2020). Activewear worn during physical activity is a consumer market that relies heavily on moisture-wicking and quick-drying fibers such as polyester. Yet polyester has been recognized as a fiber that can retain and release strong body odors following wear (McQueen & Vaezafshar, 2020). Since aerobic bacteria that live on the skin can metabolize sweat to generate odor (Taylor et al., 2003), then antimicrobial (AM) finishes may be used to prevent odor from accumulating clothing (Broadhead et al., 2021). Other types of odor control treatments that rely upon absorption or neutralize odor can also be applied to fibers/fabric to prevent odor in activewear apparel (McQueen & Vaezafshar, 2020).

Assumptions are sometimes made that AM and/or anti-odor (AO) finishes on fabrics will result in consumers laundering their clothing less than a non-treated garment. This potential for environmental savings that can be made through a reduction in laundering has been promoted by companies of AM or AO technologies (Anon, 2020; O'Rourke & Strand, 2017). However, a reduction in laundering frequency requires the AM treatment and/or AO finish to be effective at preventing odor. Yet, some studies have found that odor reduction in odor-control polyester fabrics is not as effective as the inherent odor-control properties of wool and cotton (Klepp et al., 2016) and there are no differences between AM-treated and untreated polyester fabrics after being worn for exercise (McQueen et al., 2013). There also appears to be no evidence that consumers do change their behavior and "wash less" their AM or odor-control clothing (Hicks et al., 2015). Exercise clothing is typically washed more than day-to-day clothing (Yates & Evans, 2016) which is likely associated with sweating. The purpose of this research was to identify whether AM-treated clothing or AO treatments applied to activewear apparel items would result in more wear, and less washing by consumers than a wicking only treatment.

The following null hypotheses were formed: H_0-1 - that there will be no difference in the frequency of laundering among exercise clothing with wicking performance only (the control [CON]), and that which has a wicking and antimicrobial (WAM) properties, and wicking and anti-odor (WAO) properties. H_0-2 - that there will be no difference in the frequency of laundering among CON, WAM and WAO exercise clothing, when: a) the decision is based on perceptible odor on the garment; and b. the decision is based on how intensely the garment had been sweated in.

Methods: An experimental survey was developed to test the hypotheses utilizing a convenience sample of university students. A between-subjects research design was employed

where respondents were provided with one of three stimuli made of hang-tag labels referencing to a 100% polyester garment with CON, WAM, or WAO properties. Respondents were randomly assigned to the three different treatment groups: CON, WAM and WAO.

Participants were provided with information about a fictious company called Fresh Clothes (FC), and the benefits of the technologies applied to the clothing was briefly explained, so that participants would understand what wicking, AM and AO were. They then viewed hang-tag labels showing an FC activewear line of apparel called Xēros. Participants were asked to respond to hypothetical questions, imagining they had worn the item of clothing once/twice/three times for exercise and indicate how likely they would be to wear it again without laundering. Respondents were then asked to indicate how likely they would wear the clothing item again if it had been worn once/twice and noticed it did not smell/smelled strongly of their own body odor, as well as if they had sweated lightly/heavily while wearing it. A 5-point Likert scale anchored by 1 - extremely unlikely to 5 - extremely likely. Prior to being put into groups, participants were also asked how frequently they washed certain types of garments and how frequently they exercise every week. The Kruskal-Wallis test was used to test for significant differences among the three treatment groups.

Results/Discussion: A total of 115 valid responses were received (71% women, 18% men, 8% non-binary, 3% prefer not to say) ranging from 18-65 years (58% 18-25, 31% 26-35, 4.3% 36-45, 6% 46+). There were 41 valid responses for CON, 34 for AM and 40 for AO. The demographics among the three groups did not statistically differ, nor did the respondents reported frequency of laundering clothing, or frequency of exercise per week.

The likelihood the garment would be worn again without laundering decreased when the previous number of wears increased, strong smell was present, or intensity of sweat increased for all treatment groups (see Figure 1). There were no significant differences among the groups for how likely the garment would be worn again. This was the case when no additional scenario was provided (Fig 1a) (e.g. Once: $H(2)=1.613$, $p=0.446$), and when smell, or sweat intensity due to exercise was included (Fig 1b and 1c) (e.g. Smells strongly, once: $H(2)=1.393$, $p=0.498$; Light sweat, twice: $H(2)=3.577$, $p=0.167$). Therefore, all of the null hypotheses were accepted.

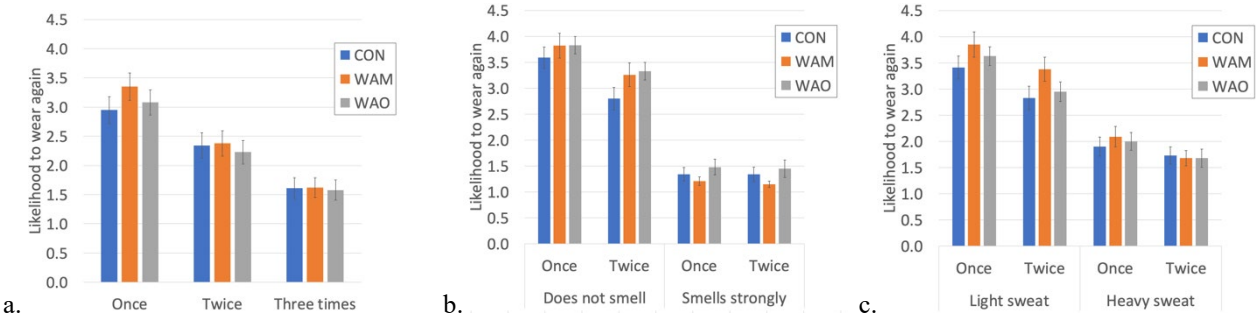

Figure 1. Differences among groups on likelihood to wear clothing again without laundering: a. based on number of wears only; b. presence of smell; c. intensity of sweating

These results suggest an AM- or AO-treated garment is not likely to be washed any less frequently than a garment that does not have a treatment. In other words, individuals are not likely to wear an AM or AO garment for a greater number of times between laundering than a standard activewear garment. These findings suggest that consumers have their own habitual or ingrained practices for when the laundry should be done.

There was evidence from the current study that consumers do treat different types of garments differently in terms of how often they wear them before washing (data not shown). For example, respondents indicated they wash athletic tops more frequently than sweaters or jeans. This finding is supported in the literature (Laitala et al., 2012; McQueen et al., 2020; Yates & Evans, 2016). Hence, the presence of an AM or AO treatment may have little impact on laundering behavior for a particular type of garment, such as, a polyester athletic shirt.

The findings of this research have significant implications for the textile industry as it relates to sustainability claims that are made in the trade off between adding additional treatments at the production stage and the laundering that occurs during the consumer use phase of a garment's life cycle. Future research includes developing the experimental to allow for a within-subjects design, increasing the sample size and broadening the demographic profile of respondents.

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