Comparison of Stain Resistance Property for Nurse's Scrub Jacket

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According to the Agency for Healthcare Research and Quality (AHRQ), approximately 180,000 nurse practitioners and physician assistants are employed in the United States (Kalisch, Gosselin, & Choi, 2012). The medical uniform industry must address issues related to nurses' scrub jackets to provide physical safety for this large nursing population (Heyes, 2012). Nurses wear these scrub jackets to maintain a hygienic environment and visually differentiate their position in the hospital setting while still being comfortable. One particularly important characteristic of scrub jackets is the need to enhance stain resistance for hygienic purposes in the medical arena (Heyes, 2012). However, when it comes to completely removing stains, including blood, medicine, beverage, and even office supply stains, the nurses' uniform industry has to fully address the stain resistance issue (Higginson et al., 2011). Data from one focus group interview indicated that any stain resistance study should include both coffee and ballpoint pen ink for testing nurses' scrub jackets as these fluids commonly stain medical staff's uniforms. Thus, this study used both coffee and ballpoint pen ink in the stain resistance test conducted on nurses' scrub jackets. The purposes of this study are to (1) examine the current scrub jacket fabrics' resistance to coffee and ballpoint pen ink stains and (2) investigate possibly more stain-resistant fabrics for use in future scrub jacket prototypes. Two hypotheses were developed for this study:

H1: A significant difference will emerge between woven and knitted fabric constructions when testing for coffee and ballpoint pen ink stain resistance.

H2: A significant difference will emerge among the ten fabrics tested for coffee and ballpoint pen ink stain resistance.

The AATCC Test Method 130-2000 condition was used to identify stain resistance according to the rating system. Multiple woven and knitted fabrics containing natural and synthetic fibers were utilized for the tests. Five different woven fabrics were selected based on their use in the current brands of scrub jackets: 100% cotton (W100C); 65% cotton and 35% polyester (W65C35P); 65% polyester and 35% rayon (W65P35R); 100% polyester (W100P); and 55% cotton, 42% polyester, and 3% spandex (W55C42P3S). In addition, five knitted fabrics were chosen to represent commercial fabrics with similar content to the current woven scrub jackets:100% cotton (K100C); 65% cotton and 35% polyester (K65C35P); 65% polyester and 35% rayon (K65P35R); 100% polyester (K100P); and 50% cotton, 48% polyester, and 2% spandex (K50C48P2S). Each of the ten fabrics was cut into four-inch squares, and five pieces of each type of fabric were prepared for the stain resistance test. All fabric samples were pre-washed using nonionic detergent in order to remove any pre-treatment chemicals on the fabrics (e.g., finishing and polish). After pre-drying all fabric specimens, several drops of black coffee and several ballpoint pen ink stains were applied in the center of each fabric specimen.

The results of both stain resistance tests were evaluated based on the efficiency of stain resistance after normal laundering and drying, using the AATCC 130-2000 test method, which is designed to measure the ability of fabrics to release stains during laundering. According to the stain release replica of AATCC Test Method 130, mean values were assigned for each fabric specimen as follows: Grade 1 indicates substantial residual stain (poor stain removal) whereas grade 5 indicates minimal residual stain (complete removal). A useful fabric would be one that achieves a grade of at least 4; however, a grade of 3 could be considered as partial removal of the stain (Usha, 2009).

The independent *t*-test highlighted significant differences in both coffee stain resistance (t (31.38) = -3.034, $p < .01$) and ballpoint pen ink stain resistance (t (48) = -3.923, $p < .01$) between woven fabrics and knitted fabrics. Thus, Hypothesis 1 was supported. Based on the ANOVA results, a significant difference was noted between the coffee-stained fabrics (F (9, 40) = 10.56, $p < .00$) and ballpoint pen ink-stained fabrics (F (9, 40) = 43.03, $p < .00$). Thus, Hypothesis 2 was also supported. In the coffee stain test, the results of the post-hoc LSD test were used to categorize W65P35R and W100P as group "A" while W55C42P3S, W100C, K65C35P, K50C48P2S, K100C, and K100P were grouped together as group "C." Meanwhile, W65C35P and K65P35R were categorized into their own group "B." Group "C" was found to have more effective coffee stain resistance than group "A"; thus, coffee stains could be more easily removed from the fabrics in group "C." For the ballpoint pen ink-stain test, group "C" (W65P35R, K65C35P, K50C48P2S, K65P35R, and K100C) scored significantly higher than group "A" (W55C42P3S and K100P). W65C35P, W100C, and W100P were categorized as group "B." The post-hoc LSD test showed that ballpoint pen ink stains could be most easily removed from the fabrics in group "C."

Based on these results, the study confirmed which nurses' scrub jacket fabrics had the best stain-resistance properties when dealing with coffee and ballpoint pen ink stains. According to the data, knitted fabrics provide better stain resistance than woven fabrics. Indeed, three knitted fabrics—namely, 100% cotton; 65% cotton and 35% polyester; and 50% cotton, 48% polyester, and 2% spandex—showed the highest resistance to both coffee and ballpoint pen ink. Such results can provide beneficial information for the medical uniform industry when deciding on appropriate fabrics to use in nurses' scrub jackets.

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