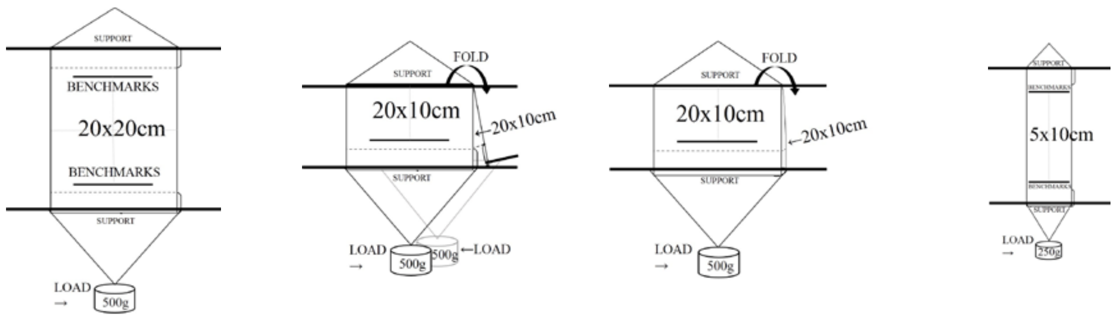
Extension and contraction of knit depending on the size of test sample and mode of external force loading

Gyeongmi Lee*, Kyunghi Hong, Yejin Lee, Dept. of Clothing & Textiles,
College of Human Ecology, Chungnam National University, South Korea

Keywords: Stretch test method, Fabric extension, Knit contraction, Pattern reduction

Building up database on the stretch deformation has not been easy, since experimental methods available use inconsistent sample width, length and force loading methods. The other reason of difficulty about fit arises from the differences in a number of holding positions of body (i.e. shoulder, arm, rib cage, waist line, etc.) exerting forces in the stretching direction of the fabric regardless of whether it is an active or reactive force. It is reflected in the pattern making as noted by Watkins, P.A., who stated that shoulder and sleeve areas are more problematic in stretch pattern construction and said that technology should be focusing on these areas. Therefore, in this study, deformation of knit was investigated by dimension of test sample and the way of loading force to compare the differences among the different testing methods, and thereby to provide a proper basis for stretch pattern constructions.

As for the width of the test sample, Ziegert and Keil used 20cm-width test samples which is almost the same size of the one side of the front panel, whereas Watkins adopted 5cm width sample from the ASTM D2594. The way of applying load are also different depending on the methods, either making small slots for inserting rod or complete loops using all the length of the sample. Therefore, we investigated the deformation of tricot knit fabrics through four test methods, from (a) to (d) as shown in Figure 1. Lengthwise extension and widthwise contraction was measured in each course, wale and bias directions for five different tricot knit. One layer of 20cm x 20cm long test sample was loaded with 500g load as Ziegert and Keil proposed in (a). With the same test sample, a rod was placed in the half of the sample to fold the test sample and each of 500g weight was loaded at each end of the sample (b). Two ends of (b) sample were sewn and 500g weight was loaded to (c). Test (d) was followed by Watkins' methods(2011).



(a) 20×20cm, 500g×1 | (c) 20×20cm, 500g×1 foldying type | (c) 20×20cm, 500g×1 loop type | (d) 5×10cm, 250g×1

Figure 1. Methods for fabric stretch test

The extension ratio of five samples along the direction of extension and the contraction ratio perpendicular to the direction of extension depending on four methods from (a) to (d) were illustrated in Figure. 2 for five samples. Samples were also tested in wale, course and bias directions.

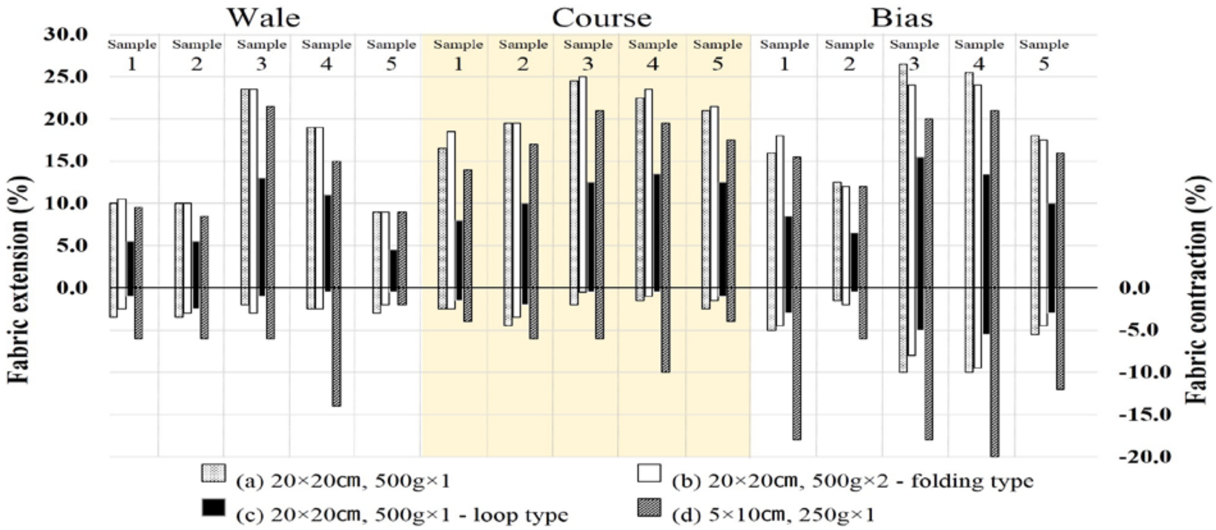


Figure 2. Extension and contraction of knit depending on four test methods and the direction of external force loading

The result shows that the difference in length of the extension direction did not affect the extension ratio. However, the ratios for samples with different width were not proportional to the weight per unit width. For example, in the case of (d), the extension ratio was not twice the extension ratio of (a) or (b) and nor was it four times the extension ratio of (c), contrary to the expectation as in the case of common materials. The extension ratio of bias direction of the five samples was not similar to the case of wale or course direction test. It was noted that the fabric contraction ratios perpendicular to the direction of extension varied significantly on five samples as well as the four methods used. Therefore, to get the necessary contraction ratio for compression garment from the extension ratio of the material, the size of the test sample needs to be different by size of the part of the pattern. In addition, attention should be placed on various contraction ratios perpendicular to the direction of extension in the pattern making of compression garment.

This research was supported by BK21 PLUS Program through the National Research Foundation of Korea(NRF) the Ministry of Education(22B20151113044).

References

Watkins, P.A. (2011). Garment pattern design and comfort. *Improving comfort in clothing*, 245-277.

Ziegert, B., & Keil, G. (1988). Stretch fabric interaction with action wearables: defining a body contouring pattern system. *Clothing and Textiles Research Journal*, *6*(4), 54-64.