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A Study on the Performance Evaluation of Commercial Functional Inner-wear

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Abstract

As health and well-being become a global trend, the younger generation is focusing on the balance between work and leisure time and they are interested in sports activities as well as a cultural life. In addition, the range of sportswear is expanding, so that athleisure fashion is getting into daily lives. In particular, consumer groups in the sportswear market are beginning to change since generation Z consumers are more and more interested in sportswear and their needs are also growing of health and functional of sports wear. It's a global trend that athleisure fashion market is growing, which combines professional athletic wear with fashion. As the number of women who enjoy sports and leisure in their spare time, the consumer pattern in the sports wear market is also expanding to female customers. However, most sports functional wears were focused on male consumers, so that functional inner-wears are mostly made for both sexes, which mean the functional inner-wears are produced without considering the physical characteristics of men and women and with not enough size division ending up not suitable for professional athletes. In particular, female professional athletes need functional inner-wear that fits the characteristics of the sport because they are not only different in physical condition and they are also using different muscles for different movements. Therefore, functional inner-wear needs pattern development and size system setting considering the body shape and athletic movement of female professional athlete.

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I. Preface

With the rise of health and well-being as a global trend, sports activities are increasing with increasing leisure time, and athleisure fashion is expanding the range of application of sportswear as daily clothes. In particular, the interest in sportswear has increased due to the tendency to focus on the health needs and functionalities of generation Z consumers, and the pattern of consumption in sportswear market has begun to change (Seo, 2019b). As the outdoor market, which has been popular among the middle-aged for its functional comfort and activity, has been reduced (Gyoun, 2018), and the athleisure fashion market that combines the professional athletic functional wear and fashion and being loved by Z-Generation is expanding (Kim, 2019). In the sportswear market where men were the main customers, the number of women who enjoy sports and leisure in their spare time is increasing (Gyoun, 2018). According to Korea Fashion Industry Research Institute, the domestic athleisure fashion market size is expected to grow from 1.5 trillion won in 2016 to 3 trillion won in 2020 (Lee, 2019).

As a result, for consumers, sports activity is more and more important in their daily lives and they are willing to spend on the proper clothing and equipment, which encourages the premium sports brand market to emerge and grow. Also, domestic consumers who value their own direct experience prefer to purchase products through offline stores (Seo, 2019a). Under Armour, a sportswear brand, succeeded in gaining positive response from athletes by focusing on inner-wear that abides by basics and functions. Currently, it presented smart running shoes, coupled with IT devices, analyzing the user's physical conditions and suggesting proper pace of workout and smart pajamas using infrared emitting materials to help sleep (Korea Trade-Investment Promotion Agency, 2019).

As the athleisure market is growing in Korea, product types and prices are also being segmented. Among them, functional inner-wear called Physical awareness active sportswear or underlayer incorporating athletic

functionality is designed to cope with the movement and the body reaction accordingly, and has smooth motion functionality and human body control function. In addition, it is a high-performance garment having futuristic ergonomics fashion design characteristics with advanced functions combined with the comfort from perfect fitting and elasticity of the elastic material (Jo, 2003; Kim & Na, 2014).

This functional inner-wear uses seamless heated welding, seamless, or flat lock seam in order to reduce the local pressure or friction between the human body and the clothing caused by seams during exercise (Jeong, 2006). Functional clothing has a close effect on muscles and joints according to the elasticity of the material and the strength of the clothing pressure, which has a positive effect on body composition and physical fitness factors (Seon, Juang, Lee, Lee, & Ki, 2008). As a result, athletes or players most of the cases wear normal sportswear over wearing compression sportswear (Kim & Song, 2010). Functional inner-wear has been known to improve muscle accuracy and efficiency by applying intensive compression to the muscles used, although it varies depending on the kinds of sport. It has been reported that functional inner-wear increases the skin elasticity as well. However, until now, objective studies on the effects of commercially available functional wears are insufficient, and this study aims to objectively verify the effectiveness of commercially available functional inner-wear and to use it as a data for designing functional inner-wear for female soccer players.

II. Methods of Study

The method of the study is to select five products of functional inner-wear on the market and let them worn by female university students aged early 20s majoring in PE before measuring muscle strength. In advance, we asked some female soccer players about their preference on the brands of domestic and overseas compression wear to find that they didn't have a distinct preference.

The experimental clothing used in this study was limited to four types of global brands and one type of

domestic brand. Global brands are the main sponsors of various international competitions and Korean brands are also selected as brands specializing in Inner-wear. Therefore, two brand (Enerskin, Fortium) that sponsored players or athletes at the Pyeongchang Olympics and three overseas global brands are selected for the study. The selection criteria are brands that sell female items using tapping technique, flat lock seam technique, and seamless technique including functionality differentiating tensions between body parts according to muscle shape. Brands are excluded of casual activity with normal function such as sweat absorption or quick drying. In

addition, the selected items were limited to clothing suitable for general running and long-term exercise, not functional wear for special sports, and limited to shorts and topless or short sleeved tops. Selected are items available for both short and long sleeves of soccer wear. The selected items for the study is shown in Table 1.

The study was conducted on the women in their 20s who majored in physical education. The participants of this experiment were women of standard body size of Size Korea, national standard physique among volunteers. The subjects are limited to women in their twenties, because this study is intended to develop inner-wear for

Table 1. Characteristics (Design, Material, Countries, Price) of Items

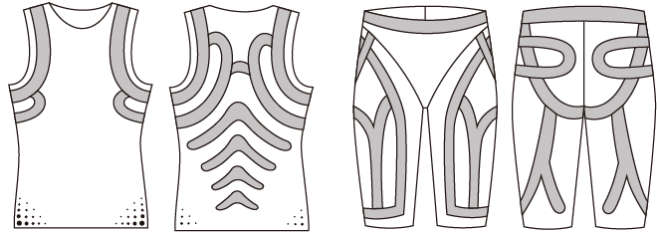
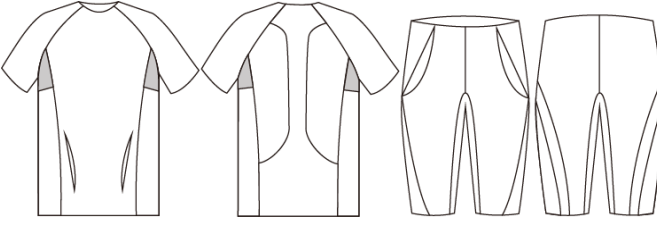
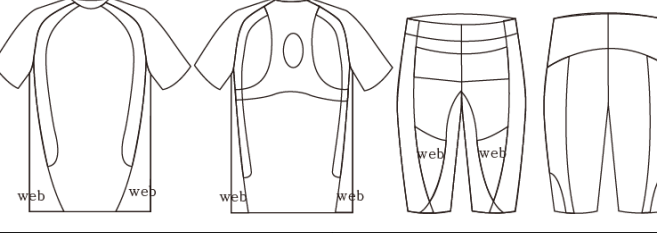
Enerskin			Material
			Nylon 65% Spandex 35% Silicon(gray)
			Nation
			U.S.A
	Top	Bottom	Design
	159,000	159,000	Price(unit: won)
Skins			Material
			net(gray) nylon 92% elastane 8% body nylon 76% elastane 24%
			Nation
			Australia
	Top	Bottom	Design
	92,000	81,000	Price(unit: won)
CW-X			Material
			Web: nylon 80% lycra 20% body:polyester 90% spandex 10%
			Nation
			U.S.A
	Top	Bottom	Design
	105,000	95,000	Price(unit: won)

Table 1. Continued

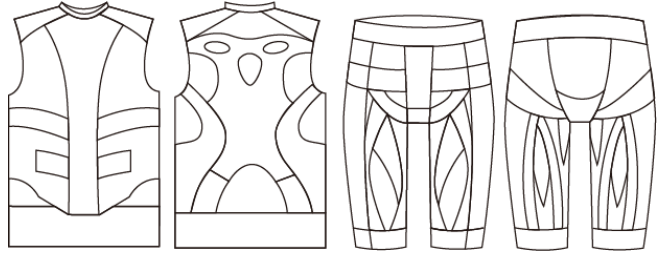
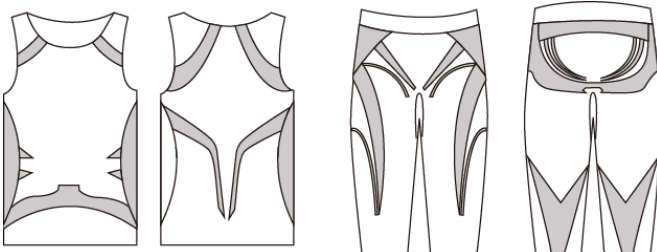
EC3D					Material
					polyamide 70% elastane 30%
					Nation
					Canada
	Top 143,000		Bottom 89,500		Design Price
Fortium					Material
					nylon 83% spandex 17% (emana fiber)
					Nation
					Korea
	Top 90,000		Bottom 70,000		Design Price(unit: won)

Table 2. Subject Body Size

(unit: cm)

Subject		Item Body Part	Enerskin	Skins	CW-X	EC3D	Fortium
A	81.0	Bust Girth	80.5	79.0	80.0	79.0	78.8
	64.0	Waist Girth	62.5	62.5	63.5	63.0	62.5
Height:164	90.0	Hip Girth	90.5	85.0	88.0	87.0	87.0
Back length:40	47.5	Thigh Girth	47.0	48.2	48.3	47.5	48.0
B	81.0	Bust Girth	81.0	81.5	82.0	81.0	80.0
	64.0	Waist Girth	62.5	62.0	61.5	66.0	66.0
Height:164	90.0	Hip Girth	89.0	86.5	90.0	91.0	89.5
Back length:40	47.5	Thigh Girth	52.0	51.5	51.0	51.5	51.0
C	81.5	Bust Girth	79.0	79.0	81.0	80.5	79.5
	65.0	Waist Girth	64.0	63.5	63.0	62.0	65.0
Height:166	92.0	Hip Girth	91.0	91.5	91.5	91.0	91.0
Back length:39	49.0	Thigh Girth	51.0	52.0	51.0	51.5	52.5

female soccer players, professional female players. The body size of the subjects and the size on wearing the items are as follows.

Subjects wore daily clothing and commercially available functional clothing (Enerskin, Skins, EC3D, CW-X) respectively and measured dynamic static muscular

endurance. Each experiment was performed for about 5 minutes, and enough rest of 30 minutes break after an experiment. Measuring instruments and methods are as follows.

1. Core Muscle Check (centaur)

The three-dimensional spinal exercise device tilts the body in four directions, back and forth, left and right, and measures the core muscle strength. The subject crosses the arm in front of the chest in the normal posture, as shown in Figure 2, with the hand on the opposite shoulder and stands straight in the circle with the right posture. When the subject's pelvis is firmly fixed to the device, the device moves in the direction as in Figure 1. At this time, if the subject's core muscle shaking is largely measured, it returns to its original position. In principle, this experiment should be

conducted only once after taking one preliminary experiment. Centaur experiment takes about seven minutes per person, and the device takes two minutes to prepare.

2. Thigh Muscle Check (CSMI)

Measure thigh muscle strength and joint movement. Measure the maximum and frequency of muscle strength at regular intervals. As shown in the Figure 2, the subject sits on the device to hold the thighs unshakable and initially measures the general thigh muscle strength before they measure the maximum strength by lifting the legs five times at high speed. Measure left and right alternately. In principle, this experiment should be conducted only once after taking one preliminary experiment. The normal measuring time per one leg is about 1 minute and 30 seconds. However, it will take

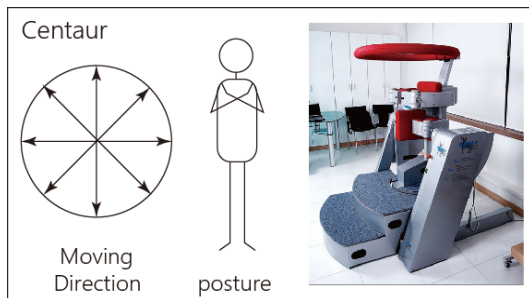


Figure 1. Centaur
(www.topspine.co.kr)

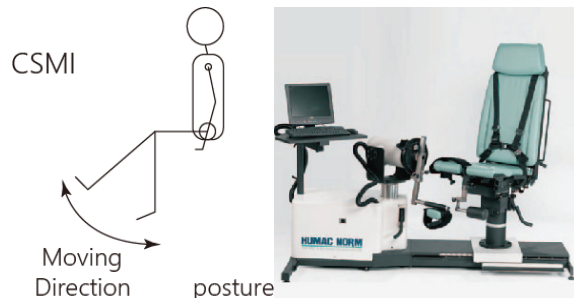


Figure 2. CSMI
(www.scottmedical.com)

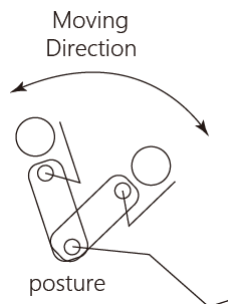


Figure 3. MEDX
(www.youchuck.co.kr)

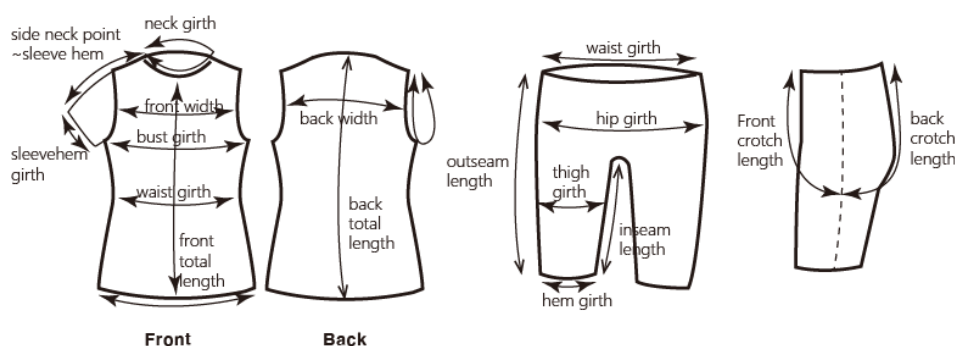


Figure 4. Measuring Part of Functional Wears

about 5 to 10 minutes considering all the time to change legs and correcting postures.

3. Equivalence Lumbar Strength Test (MEDX-lumbar extension machine)

Sit fixing the pelvis to measure the flexibility and the strength of the back by leaning forward and flip back as far back as possible five times. Exclude gravity (Figure 3). This experiment also should be conducted only once after taking one preliminary experiment. In the case of MEDX the first posture should not be changed again, so that one person can finish the experiment within 5 minutes. Centaur and CSMI were performed on all functional apparel, and MEDX measured only top three apparel ranked in subjective and objective evaluation. MEDX uses virtually the same muscle as Centaur, but it can measure core muscles more intensively.

III. Research and Results

1. Figures of the Measurements

Table 3 shows the measurement of each size before wearing functional inner-wear. Some brands stipulated the size measurements for proper body size or others marked as letters such as S and M. In this study, S is considered equivalent to 90, the smallest dimension. Skins

and CW-X chose do not produce sleeveless top, so that short-sleeved tops are selected and the bottoms are all limited to knee-length shorts. Only EC3D has a longer front than the back, and only this brand has a three-dimensional design of the hips. Skins and Fortium products have a base. Skins is rhombic, and Fortium is oval. Enerskin, EC3D and Fortium were made with seamless knitted techniques to vary strength depending on muscle location. Skins and CW-X are using flat seam sewing, and only Enerskin is silicone taped making it difficult to wear. Figure 4 shows the measured part of the product, and Table 3 shows the measured values of the product.

Comparing the values in Table 2 and Table 3, Skins has a larger size than Enerskin and Fortium, but the body sizes of the subjects showed little difference. Fortium, which had the smallest product dimension, showed a small or rather large difference in the waist girth of the subject while tightening the bust girth. The thigh girth was the least before and after wearing and the bust girth was the largest. Fortium and EC3D, which use seamless method, showed distinct differences in shape. As for tops, Fortium had different strength at the waist and flanks, and EC3D showed different tensions at the center, side, and chest of the shoulder, upper body. As for bottoms, Fortium holds hip muscles and thigh muscles and gives different tension to the hip joint. EC3D divided bottoms into five patterns to sew them in

flat seam and rendered different tensions in the front and back rather than the sides of the hips and thighs. As for bottoms, the Fortium holds the hip muscles and thigh-side muscles, while the front hip-joint area is made to be more stretched than other parts. The EC3D was constructed by dividing the bottom into five patterns and sealing the bottom with flat seams, three-dimensional design of the hip part and fine segmentation of the front and rear parts rather than the sides of the thighs, varying in strength and elongation.

2. Subjective Evaluation

In the subjective evaluation of wearing test, there was a slight difference in the degree of tightening or baggage in tops, but in bottoms. Most of the shorts except Enerskin did not show a big difference in each part, yet the two brands differ only in waist girth. In the case of CW-X, the waist was tightly tightened despite being measured in a fully loosened state because the waist was adjustable with a strap in addition to the rubber band at the

Table 3. Actual Measurement of Functional Wears (unit: cm)

Item	Brand Size	Enerskin		Skins		CW-X		EC3D		Fortium	
		B:90/S	B:95/M	B:90/S	B:95/M	B:90/S	B:95/M	B:90/S	B:95/M	B:90/S	B:95/M
Upper Garment (unit:cm)	Bust Girth	32.2	34.5	35.0	36.5	38.0	39.0	29.0	33.0	28.0	32.0
	Front Width	21.0	22.0	27.0	27.5	29.5	31.0	26.5	30.0	24.0	25.5
	Back Width	22.5	23.5	27.0	29.0	30.5	33.0	27.0	30.5	24.0	25.5
	Waist Girth	27.0	28.0	28.0	31.0	34.0	35.5	28.5	33.0	27.0	31.5
	Hem Girth	26.2	28.0	33.0	34.5	36.0	38.0	30.2	36.0	29.0	33.2
	Neck Girth	38.0	41.0	46.0	48.0	40.5	43.0	39.0	41.0	60.5	62.0
	Armhole Girth	43.0	45.0	30.4	31.2	34.0	36.0	36.0	42.0	39.0	40.0
	Side neck Point~Wrist			23.0	28.5	28.5	29.0				
	Wrist girth			11.5	4.2	13.0	13.0				
Total Length F/B	46.0/49.0	48.0/52.0	45.0/47.5	47.5/54.0	52.0/56.0	55.0/59.0	44.0/43.0	48.0/46.0	39.5/47.0	41.0/48.0	
Lower Garment (unit:cm)	Waist Girth	26.0	27.0	31.5	33.7	29.5	32.0	28.5	30.5	25.7	27.7
	Hip Girth	33.0	34.0	35.0	38.0	32.5	36.0	27.0/34.0	28.0/36.0	26.5	28.5
	Thigh Girth	17.0	18.0	15.7	15.2	17.0	19.0	12.2	13.5	15.0	16.2
	HemGirth	13.5	14.2	13.7	14.0	15.0	15.8	12.5	14.0	10.5	11.5
	Crotch Length F/B	16.6/24.4	16.0/25.5	21.0/24.5	22.0/25.5	23.0/30.0	25.5/32.0	19.0/22.5	21.5/25.5	17.7/21.0	19.5/22.8
	Inseam Length	25.0	26.5	23.0	25.0	24.0	25.0	20.5	21.8	40.0	41.0
	Outseam Length	37.0	39.0	40.0	44.0	45.0	46.3	38.0	45.0	49.0	59.0

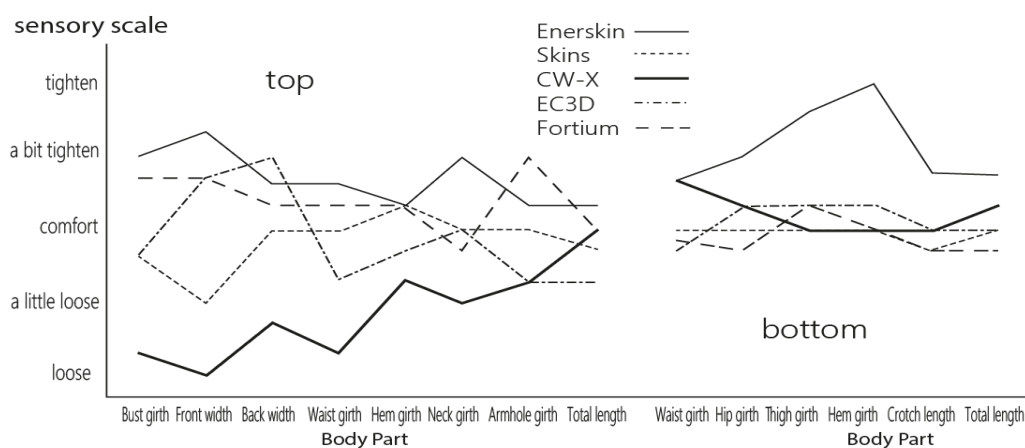


Figure 5. Subjective Evaluation for Functional Wears

waist.sk In case of tops, the overall tightness was found in the order of Enerskin > Fortium > EC3D > Skins > CW-X, and Enerskin showed the strongest tightening of the front part. It is thought that this brand is made as a unisex apparel made in a flat design without any volume. Skins didn't feel tight at the front, but actually showed the most comfortable fit, despite the reduced size of the chest after wearing (Figure 5).

This is the best evaluation in the part of the material that feels on the skin because the material is thin and elastic. Next were Fortium and EC3D, both of which are designed in varying strength depending on the muscle area with seamless technique. In particular, the bottoms of EC3D were three-dimensional but did not affect the subjective evaluation of the wearer. In the subjective evaluation on working performance, Enerskin received the best rating, followed by Fortium, which showed higher levels of body tight than other brands. In the subjective athletic functional evaluation, Enerskin was rated best, followed by the Fortium product, which showed that the brands' body-tightening was higher than other brands.

3. Measurement Results of Exercise Functionality

MEDX test was carried out with three types of products

that dominate the previous results. In general, MEDX measures the strength of the muscles, which are almost the same as Centaur. In this experiment, Fortium product, which compresses strength differently according to the muscle position of the back, showed the best value. Subject A showed low values at the beginning, but Enerskin showed balanced use of muscle strength than Skins. In the case of core muscles, the effect is highly evaluated when the muscles are in close contact with the body. For bottoms, it has a negative effect when tightly tightened. In Centaur, which tests the support of the core muscle, the maximum muscle strength is about 66. The lowest value was 44.9 and the highest was 66.

There was a difference in core support ability among subjects. In case of subject B, general clothes were better evaluated, and most functional clothes had a positive effect on core muscles. However, CW-X got a response that it was loose at the waist, and the core bearing capacity was decreased at the forward 45 degree angle and the rear 45 degree angle. Enhancement in the balance and strength of overall muscle can be seen in Enerskin, Skins and Fortium products. Subject A's bearing capacity was significantly low with general clothing at the angle of forward 45 degrees, but functional clothing was found to compensate for this. In

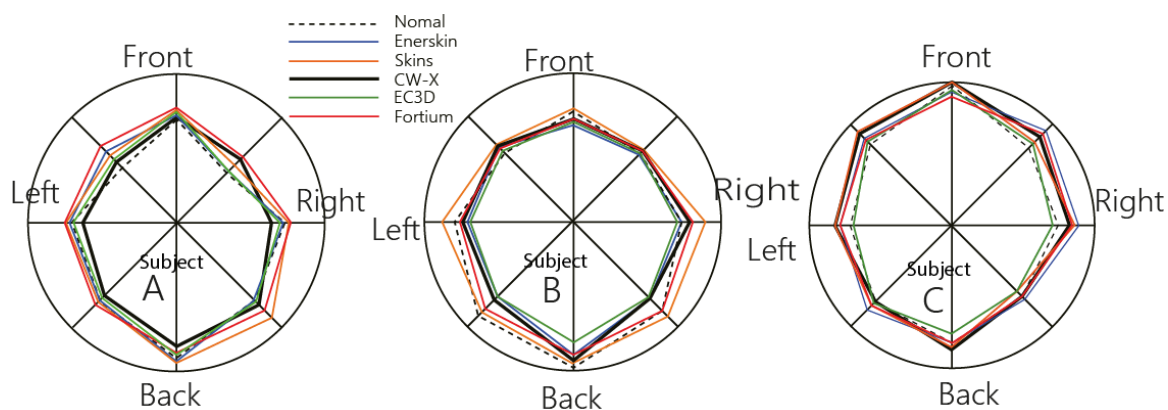


Figure 6. Centaur Test Result

Table 4. Speed & Muscle Endurance of Thigh (CSMI Test Result)

		Normal	Enerskin	Skins	CW-X	EC3D	Fortium
Speed Peak Torque	R	142	134	138	118	115	127
	L	132	119	108	106	107	114
	R	126	115	119	110	110	110
	L	126	110	122	107	102	113
	R	142	137	129	130	119	136
	L	135	134	118	108	106	123
Muscular endurance Peak Torque	R	84	77	79	79	76	72
	L	69	72	62	64	69	66
	R	81	77	75	69	69	69
	L	76	71	75	66	72	76
	R	84	83	84	89	87	84
	L	64	81	85	77	87	87
Endurance Rtio	R	84	94	83	89	81	97
	L	92	87	86	96	75	84
	R	77	83	79	87	78	88
	L	77	79	82	93	80	82
	R	76	77	84	79	75	78
	L	77	78	84	85	78	76

addition, the support of most muscles is increased in the direction where the support of muscles is evaluated low, and as a result, the functional clothing helps to strengthen the muscles (Figure 6).

The results of the measurement of the rotational speed

and endurance of the thigh muscle showed the best results in the order of Enerskin > Skins > Fortium (Table 4). Fortium products outperformed the previous two products, although they tended to fall compared to the value measured without wearing functional clothing at

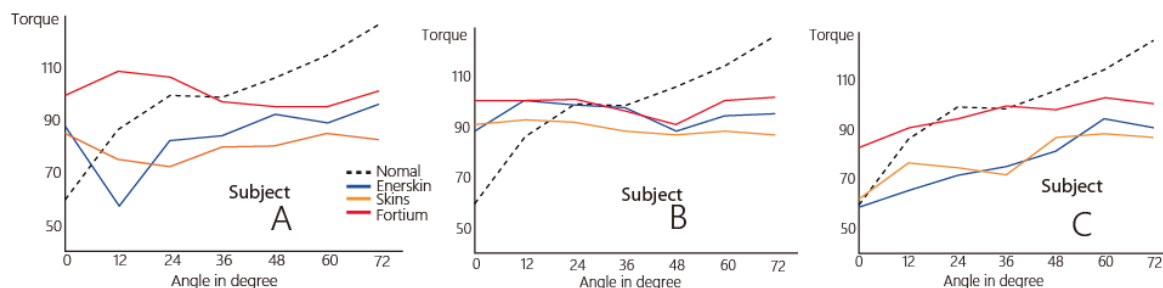


Figure 7. MEDX Test Result

first, and overall, the numbers tended to drop toward later when wearing functional clothes. Except for subject C, muscle endurance showed a large difference between subjects when it tended to decrease as the experiment was repeated. The percentage of muscle endurance that most influences long-running or walking exercise is CW-X > Fortium, followed by Enerskin and Skins. In the endurance test of all functional wear, the figure is higher than that of general clothing, and it can be seen that the functional clothing supports the muscles and improves the exercise performance. The lowest-valued EC3D products showed less thigh tightening in bottoms compared to the lower back or hips. Skins products that have been tightened and balanced throughout the body also have positive results on working performance. In the case of Enerskin, which was positively evaluated in this experiment, the front thighs and back hamstring were muscle-supported silicone, and the Skins was designed to hold the back of the thigh.

MEDX test was carried out with three types of products that dominate the previous results. In general, MEDX measures the strength of the muscles, which are almost the same as Centaur, and it can be said that the muscles at the back work more. In this experiment, Fortium products, which compresses with different strength according to the position of the muscle at the back, showed the best value (Figure 7). Subject A showed low values in the starting position. However, Enerskin showed more balanced use of muscle strength

than Skins. In case of the core muscles, the effect was higher when the muscle was closely attached to the body in support of the muscle, and as for bottoms, there was a negative effect when the muscle was tightly tightened.

IV. Conclusions

The inner-wear products on market are not divided into male's and female's as in patterns regardless of top and bottom. Only sizes are varied in 4 ~ 7 ranges to cover chest circumference 80 ~ 110cm and hip circumference 84 ~ 125cm.

In subjective evaluation, thin and stretchable Skins received the best evaluation in terms of skin texture and easy dressing and undressing. Experimental results showed that Enerskin with silicone padding was uncomfortable to put on and take off, but it was evaluated as most positive along with Fortium to hold exercise muscles. At the same time, it was suggested that tight tops could also help to hold the chest from shaking even with light running. The kinetic experimenters suggested that the preference for experiment-clothing may vary depending on endurance or momentary strength in the evaluation of each brand's characteristics. In other words, functional inner-wear suggests a need to be distinguished by exercise type. As for tops of EC3D and CW-X are designed in a little loose size than other brands, that they were evaluated to be not so much different from general casual sportswear. However, they

were proved to be suitable for cardiovascular exercise carried out over 1 hour. EC3D was not significantly different from Fortium or Enerskins in product dimensions, but it was relatively less tightened due to its three-dimensional design with different kind of knitting in different parts. Fortium and EC3D, which used the tension-bearing seamless method, were made with different strengths according to muscle activity categories, but compared to other brands, the materials were relatively thick to get a negative evaluation when worn for a long time.

In the core muscle check using Centaur among the objective evaluations, Enerskin, Skins, and Fortium showed excellent results, while in the muscle function measurement (CSMI), they got similar performance evaluation. However, in the isometric lumbar muscle force test, Enerskin got more positive results than Fortium. There were few other opinions on the patterns of functional inner-wear, but it was suggested that improvement is necessary because wearing sports bra and wearing functional inner-wear are inconvenient. In addition in the case of shorts, there is not much discomfort due to the stretchy characteristics, but the fit of the shorts appeared different depending on the degree of tightening and the rise length of the shorts. This is due to the fact that the experimental functional wear is made without any size distinction without considering the physical characteristics of women and men. This experiment did not measure the degree of muscle fatigue through aerobic exercise for more than 1 hour, but through various strength tests, it was possible to obtain information useful for the production of functional inner-wear. Functional inner-wear is strongly recommended to support the core muscles as well as muscles with large range of activity, but excessive strength can relatively inhibit the activity of the muscles. The feel of sportswear should be soft to the skin and thinner than regular t-shirts but not translucent. Patterns for chest part should be differentiated from that of general unisex apparel and the size system as well needs enhancement to be proper for female body.

In conclusion, functional inner-wear tops for female

athletes or players should be closely fit to the chest to minimize shaking but should not feel stuffy due to strong pressure on the chest during long exercise. In addition, in order to reduce fatigue during exercise and increase exercise functionality, core muscles mainly around the waist should be supported. In case of bottoms, supporting the thighs and hip muscles is important since they are the largest muscles in the body. Compared to males, females have a greater variation in chest circumference, waist circumference, and hip circumference, so that a proper pattern design is considering such characteristics of female and more detailed size system are needed. Compared to men, women need a pattern design and a more granular size system, considering the wide variations in bust girth, waist girth and hip girth.

Reference

- Centaur. (n.d.). Retrieved October 5, 2019, from http://www.topspine.co.kr/sub1_6.html
- CSMI. (n.d.). Retrieved October 5, 2019, from http://www.scottmedical.com/item/csmi_norm_isokinetic_system/174/82/99/
- Gyoun, D. (2018, December 4). 스포츠 웨어 입고 다시 뛰는 '삼성물산' [Samsung C&T] to run again in sportswear] *Economy Review*. Retrieved November 7, 2019, from <http://www.econovill.com/>
- Jeong, Y. (2006). *Fundamental relationship between reduction rates of stretch fabrics and clothing pressure* (Unpublished doctoral dissertation). ChungNam National University, Daejeon, Korea.
- Jo, K. (2003). *스트레치 소재에 의한 현대패션의 미* [Aesthetics of contemporary fashion in stretch fabrics]. Seoul, Korea: Kyoungchunsa.
- Kim, H. J., & Na, H. S. (2014). A study on ergonomics fashion design. *The Society of Fashion & Textile Research Journal*, 16(3), 434-445. <http://dx.doi.org/10.5805/sfti.2014.16.3.434>
- Kim, T., & Song, M. (2010). Effect of wearing compression clothing on body shape. *Journal of Korean Society of Clothing Industry*, 12(2), 233-239.

- <https://doi.org/10.5805/KSCI.2010.12.2.233>
MDEX. (n.d.). Retrieved October 5, 2019, from <http://www.youchuck.co.kr/ab-1047>
- Trade-Investment Promotion Agency. (2019, July 22). 미국, 애슬레저 (athleisure) 트렌드에 열광하다 [U.S. Be enthusiastic about athleisure trend]. *Korea Federation of Textile Industries*. Retrieved November 7, 2019, from <http://www.kofoti.or.kr>
- Lee, J. (2019, March 11). 믿을 건 운동복뿐...패션업계 '애슬레저' 열풍 [The only thing I can trust is an exercise suit. the fashion industry's 'Athleisure' craze]. *ChosunBiz*. Retrieved October 12, 2019, from <https://biz.chosun.com>
- Rim, S. (2019, September 6). 미국 스포츠웨어 시장동향 [US Sportswear Market Trend]. *Korea Trade-Investment Promotion Agency*. Retrieved November 7, 2019 from <http://news.kotra.or.kr/>
- Seo, J. (2019a, January 18). Z세대 스포츠웨어 큰손으로 부상 [Z generation sportswear rise with big hands]. *Fashion Insight*. Retrieved November 5, 2019 from <http://www.fi.co.kr/>
- Seo, J. (2019b, July 15). Z세대, 애슬레저는 스타일이 생명 [Z-generation, athleisure is important in style]. *Fashion Insight*. Retrieved November 5, 2019, from <http://www.fi.co.kr/>
- Seon, S., Juang, D., Lee, K., Lee, H., & Ki, S. (2008). The Effects of compression garments on the blood lipid, body composition, and fitness in obese women. *Korean Journal of Sport Science*, 19(3), 39-50.

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