

DEVELOPMENT OF KARATE GI FABRIC WITH ENHANCED PERFORMANCE

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Abstract

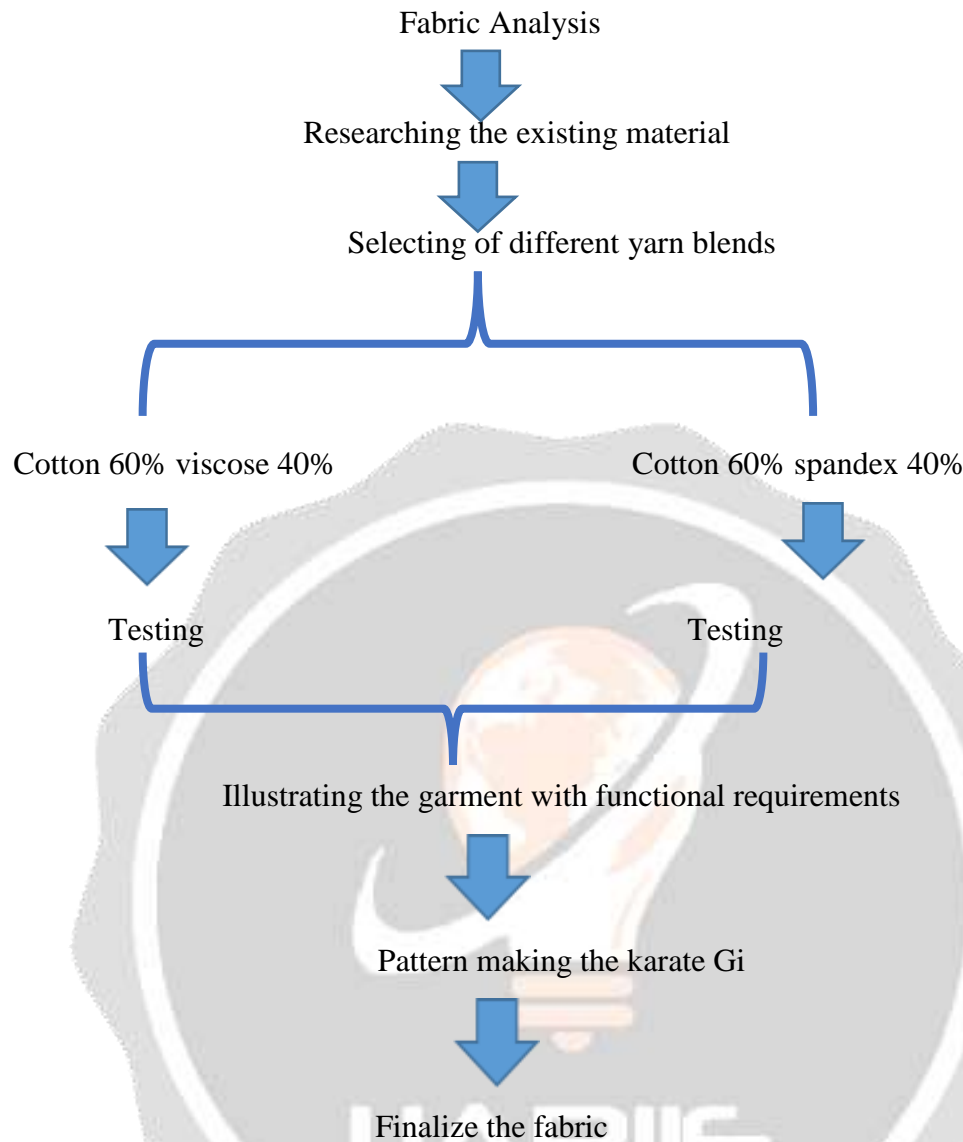
Karate Gi is a uniform used for karate practice and competition. To promote commonality among the students and for the fosters a sense of pride so they wear karate uniform. The problem in Karate Gi is about the improper permeability in the garment with proper plain weave structure and the user face difficulty in wearing the uniform for the longer duration of time this affects the wearer by getting tired in a few hours due to high GSM of garment. This study is to solve the wearer difficulties by designing the garment with proper permeable construction and by choosing the right fabric with comfortable blending proportion. For choosing the fibre blend we have collected information with other branded karate uniform fabric usage, and we have compared the fibre and GSM of the fabric. Further we have identified that the fabric is been manufactured only by the cotton polyester, 100% cotton, cotton canvas. So that we have planned to choose new blending ratios to develop and design with new product. Then we select the cotton viscose (40: 60) natural fibre, cotton spandex (40 :60) synthetic fibre and purchased the blended yarn with 10s count to increase the thickness of fabric and weave the fabric with less GSM. And then fabric has been tested with comfort properties and compare with polyester cotton (40:60). By the result of comfort properties, we can identify the right fabric to use. For further development we have the developed pattern and construct the garment with proper design formulation and test them with wearer and find out the comfort properties

Keywords: Karate, Permeability, Blend, Comfort, Design formulation

Introduction:

The Karate uniform is called as Gi. Traditional people mention as dogi which means uniform a dogi means the cloth of the way and they are calling your uniform a keikogi means the cloth of practice. In fact, we should refer to our uniform as a karate Gi if you practice karate and a judogi if you practice judo, and so on. Despite the Gi looking like the kimono it is incorrect to refer to the uniform in this way. The kimono is the traditional Japanese garment and wearing one is a highly ritualized tradition and is associated with endless rules of etiquette. The Gi is made from cotton of varying thicknesses although some practitioners now wear Gi made from the new moisture wicking high-tech polyester material, which is breathable and non-absorbent. Most students wear a lightweight cotton Gi of about 6 to 8oz thickness. It is durable enough but doesn't stand up too much grappling. The jacket of the Gi crosses left side over the right side. The only exception of this rule is when the undertaker dresses the body for burial and the jacket is crossed right over left. The pants of the Gi normally have an elasticated waist making it easy for kids to wear but a traditional Gi will have the old-style drawstring closure. The psychology behind wearing a Gi to class is science behind wearing a Gi and it is closely linked to mental health. Other benefits of wearing the karate Gi are It promotes commonality among the students, it fosters a sense of pride, it sets boundaries and helps participants see the dojo and karate class as a working environment and it gives a sense of community, confidence, respect, and discipline.

Materials and Methods



Data survey: Karate Gi is used for karate training and competition by wearing the uniform for long duration wearer gets improper permeability during the action and movements. Due to high GSM the wearer feel difficulty in wearing and get tired in few hours. This leads to difficulties during the competition by wearing them for the whole day till the match ends.

Fabric identification: We have collected the information of every brand and identify the fabric they used for. And collected the fabric weight from all brands and compare with other brand to identify the maximum weight of the fabric. By comparing with other brands, we come to know that all garments are designed only by cotton and polyester fabric with different blend proportion of with pure cotton and polyester.

Fabric bend proportion: We have planned to develop the fabric with cotton 60% viscose 40% and cotton 60% spandex 40%. By making the fabric, garment get flexible in some point of movement, comfortable in washing, shrinkage resistance and breathability.

Illustrating the garment: A concept of plan should be created under the functional requirements of the fabric. That requirements are planned and created in adobe illustrator. That plan of creation is executed to develop a garment.

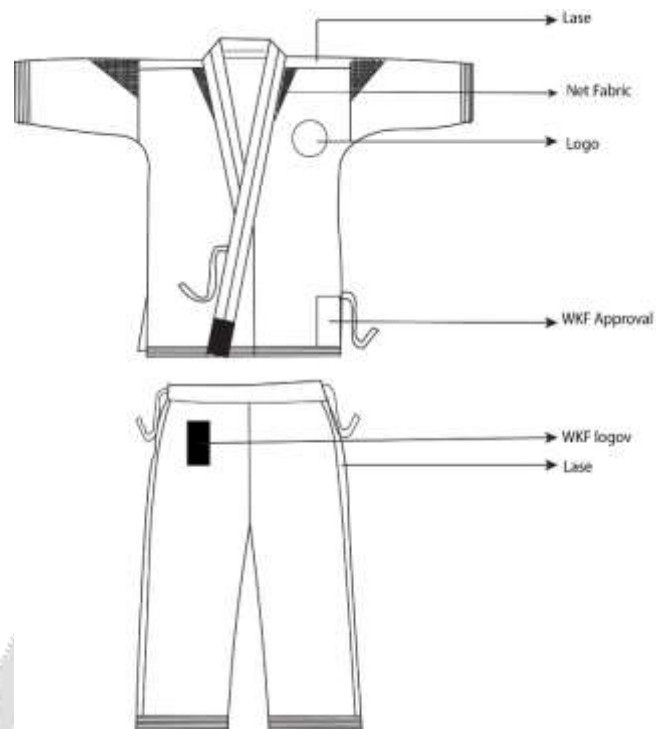


Figure.1. Illustration

Pattern making of karate gi: Patterns are used to cut the fabric pieces and the garment is made. Pattern are made so that the same style can be duplicated when needed and multiple pieces can be made. Precise coordination of the pattern in all fabric piles ensure that the same consistent appearance of the designs is maintained in all the garment produced.

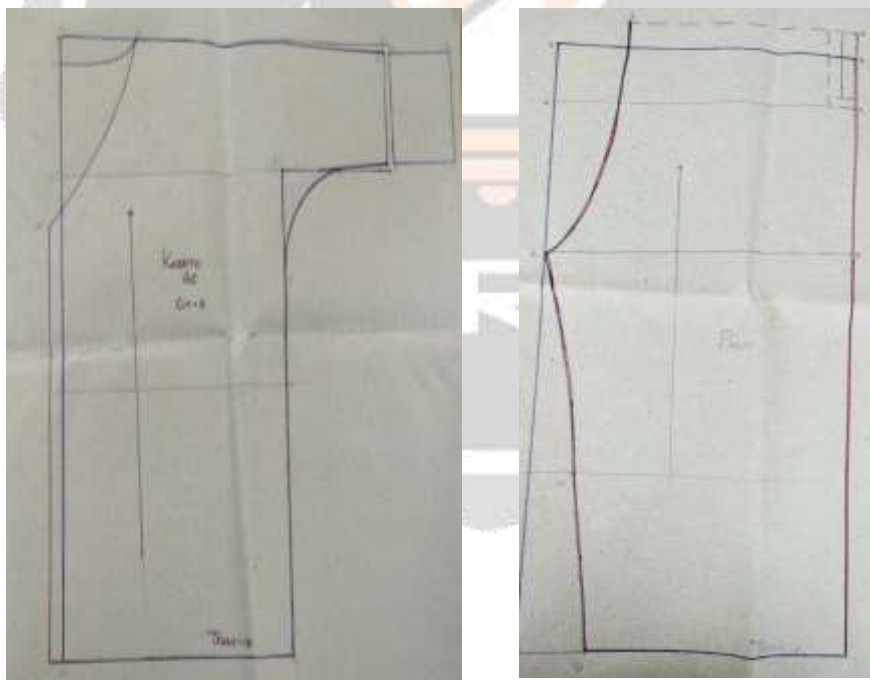


Figure.2. Gi Pattern

Comfort properties: Clothing comfort is one of the major current concerns of textile and garment manufacturers. Comfort is based on the human sensory response to clothing materials and is determined by a variety of thermal, physiological, and mechanical parameters. The ranges of indoor temperature, humidity, and air movement, under which most persons enjoy mental and physical well-being.

Results & Discussion

Fabric testing result

S.NO	Fabric Particulars	Standard	Cotton 60% Polyester 40%	Cotton 60% Viscose 40%	Cotton 60% Spandex 40%
1.	EPI	80+/-2	80	98	84
2.	PPI	42+/-2	44	57	42
3.	Count	20s	2/20s	2/20s	2/20s
4.	Tensile strength Warp- lengthwise – Newton Weft – lengthwise – Newton	1200N (min) 650N (min)	142.72 739.37	915 689	550 421
10.	Tearing strength Warp- lengthwise – Newton Weft – lengthwise – Newton	50N (Min) 50N(Min)	142.25 98.13	69.97 57.64	15.15 12.16
11.	Air permeability cm ³ / sec/ cm ² , minimum	50 (min)	58.23	89.32	88.89
12	Ratio	60:40	60:40	60:40	60:40
13	Weight gm/m ²	250 to 420	403	192	195
14.	Thermal conductivity (W/mk)	0.1287 to 0.2321	0.1883	0.1645	0.1458
15.	Abrasion Resistance (50000 cycles)	No thread breakage	No thread breakage	No thread breakage	No thread breakage
16.	Shrinkage % Warp (lengthwise) Weft(widthwise)	- - 1% - 1%	0.57 0.31	0.52 0.34	0.68 0.51
17.	Water vapor permeability g/m ² /day (min)	1400 (min)	1525	1616	1824

18.	Pilling after 5 hours of the test (min)	5	5	5	5
19.	Crimp (%)	2% (max)	1.25	1.22	1.75

Table.1. Comfort properties.

ENDS PER INCH (EPI)

The fabric ends per inch are tested in IS 3442: 1980 by inch glass and determining the number of threads in the inch and the test is repeated 5 times to identify the average result. After finding the result we compared the reading with cotton polyester, cotton viscose, and cotton spandex fabric. By comparing with three fabrics cotton viscose has high ends per inch.

PICKS PER INCH (PPI)

The fabric picks per inch are tested by pick glass and the test is repeated 5 times to identify the average result. After finding the result we compared the reading with cotton polyester, cotton viscose, and cotton spandex fabric. By comparing with three fabrics cotton viscose has high picks per inch.

COUNT

The count has been tested by IS 3442: 1980 Standards by the Beasley balance tester. The fabric is cut by using the template and the thread is unraveled from the fabric the certain unraveled thread is hanging on the hook on the Beasley balance tester until the datum line matches and the test is repeated 5 times to identify the average result. After finding the result we compared the reading with cotton polyester, cotton viscose, and cotton spandex fabric. By comparing with three fabrics has an equal count of 20s.

TENSILE STRENGTH

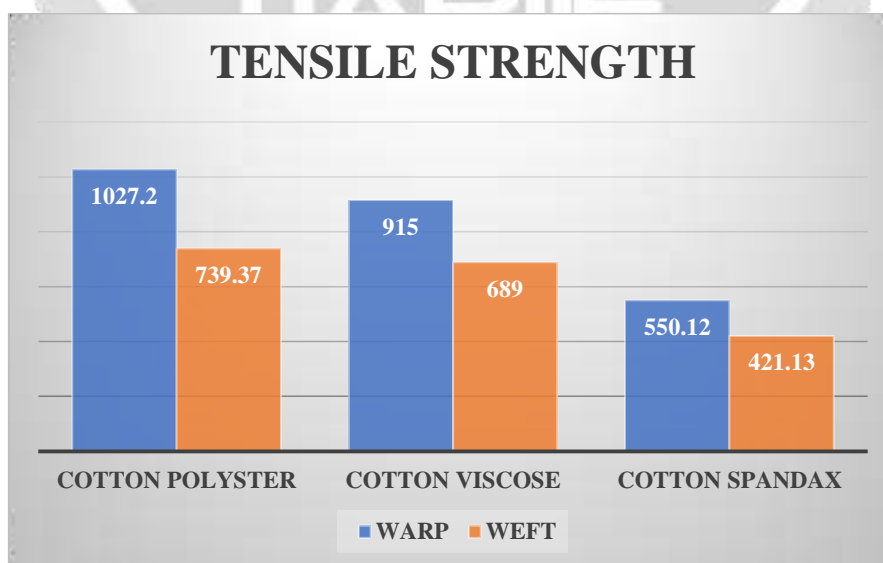


Figure.3. Tensile strength test

Tensile strength is tested in ASTM D638 standards by clipping the fabric in between the top and bottom jaw of 8 inches X 2 inches and a certain load is applied to the fabric. At the weakest point, the fabric gets torn. And the reading

is noted and the process is repeated 5 times to get an average of the tearing strength. This is followed to compare the test between cotton viscose, and cotton spandex to find out the best one. By this comparison, cotton viscose has high tensile strength.

TEARING STRENGTH

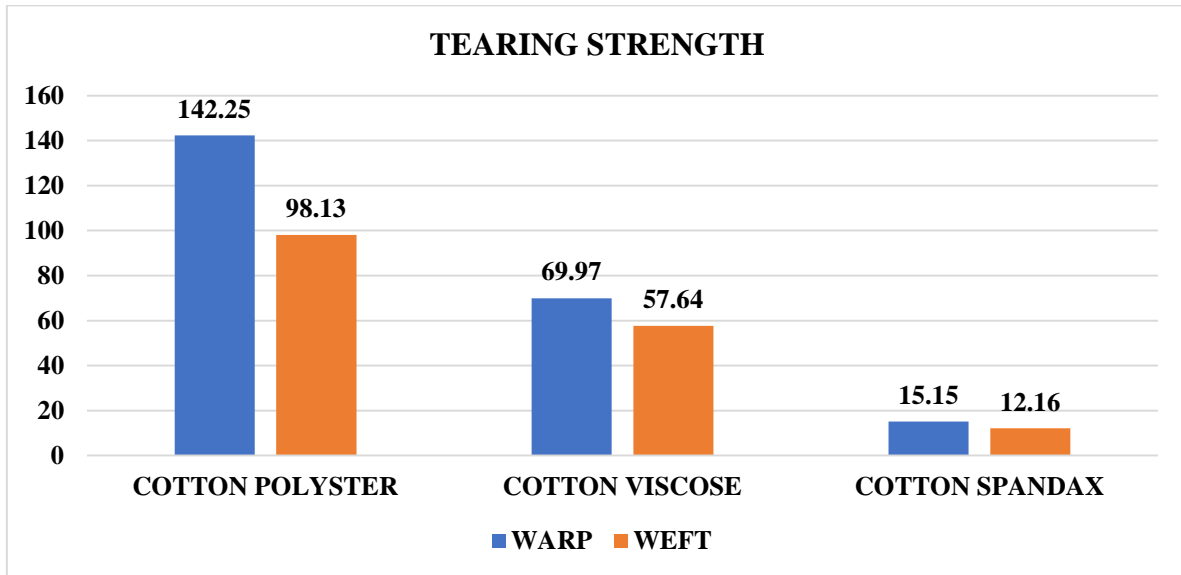


Figure.4. Tearing Strength

Tearing strength is tested in ASTM D1682 of wing rip tear tester by cutting the fabric using the template and holding the specimen with two clamps, stationary and moveable, and for tearing it by fall of the pendulum due to force of gravity. And the reading is noted and the process is repeated 5 times to get an average of the tearing strength. This is followed to compare the test between cotton viscose, and cotton spandex to find out the best one. By this comparison, cotton polyester has a high thickness so the tearing strength will be high. And by comparing with cotton viscose and cotton spandex, cotton viscose has high tearing strength.

AIR PERMEABILITY

Air permeability is tested in IS 11056: 1984 the tester by passing the air in the specimen so that the fabric pores get larger and the airflow through the fabric is tested. By this, the reading is calculated 5 times for finding the average reading. By comparing cotton viscose, and cotton spandex to find the best one. As per the project, we need more permeability of air thus cotton viscose has more air permeability compared to others.

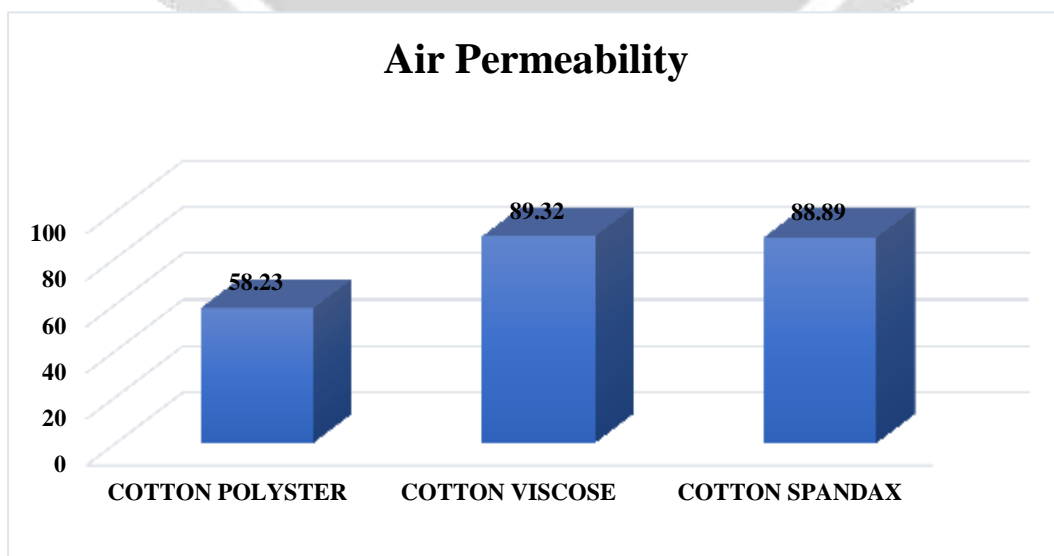


Figure.5. Air permeability

THERMAL CONDUCTIVITY

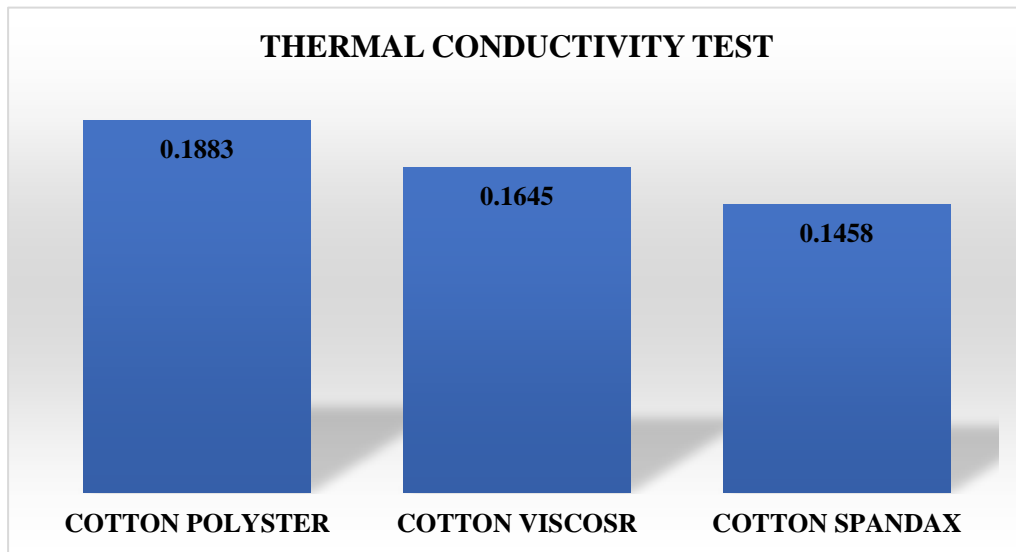


Figure.6. ThermalConductivity

Thermal conductivity is tested in ASTM -D7340 in Lee’s disc method. The Lee method is done and notes down the values by stopwatch when it reduces up to 5. This is repeated 5 times to take the average reading. By comparing cotton viscose, and cotton spandex to find the best one. By comparing with other fabrics cotton polyester is high in 400 GSM. By comparing with cotton viscose and cotton spandex fabric provides good thermal comfort and that has been compensated for the gain or loss of heat to keep body temperature in equilibrium and make the wearer feels satisfied with the thermal environment required to use the wearer thermo-regulator mechanism.

SHRINKAGE

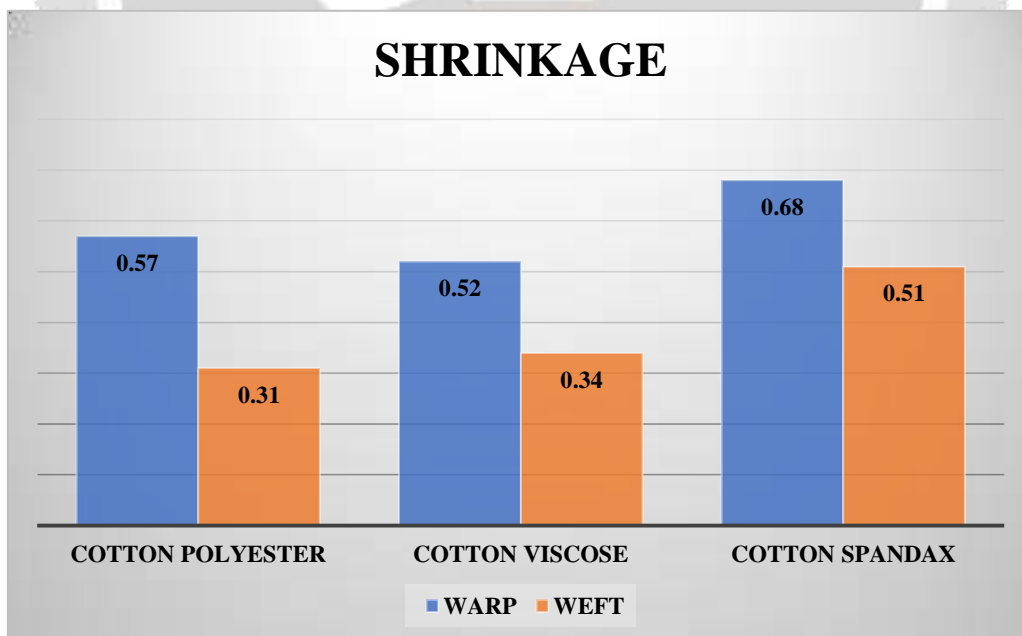


Figure.7. Shrinkage

Shrinkage is tested in IS 2977: 1967 standard by washing the fabric before and after drying. By comparing cotton viscose, and cotton spandex to find the best one. By comparing with other fabrics cotton spandex gets more shrinkage in warp and weft directions. Thus, we can conclude that cotton spandex has high shrinkage but all the fabric has a normal shrinkage percentage so all the fabric has a good shrinkage level.

WATER VAPOR PERMEABILITY

Water vapor permeability is tested in ASTM E-96/E standard and it is tested before WVTR and after WVTR. By comparing cotton polyester, cotton viscose, and cotton spandex. By comparing with other fabrics cotton spandex is high in percentage. As we know cotton polyester has 400 GSM with the thickest structure due to fewer pores the water vapor permeability will be low. Compared with cotton viscose and cotton spandex, cotton spandex has more weight loss.

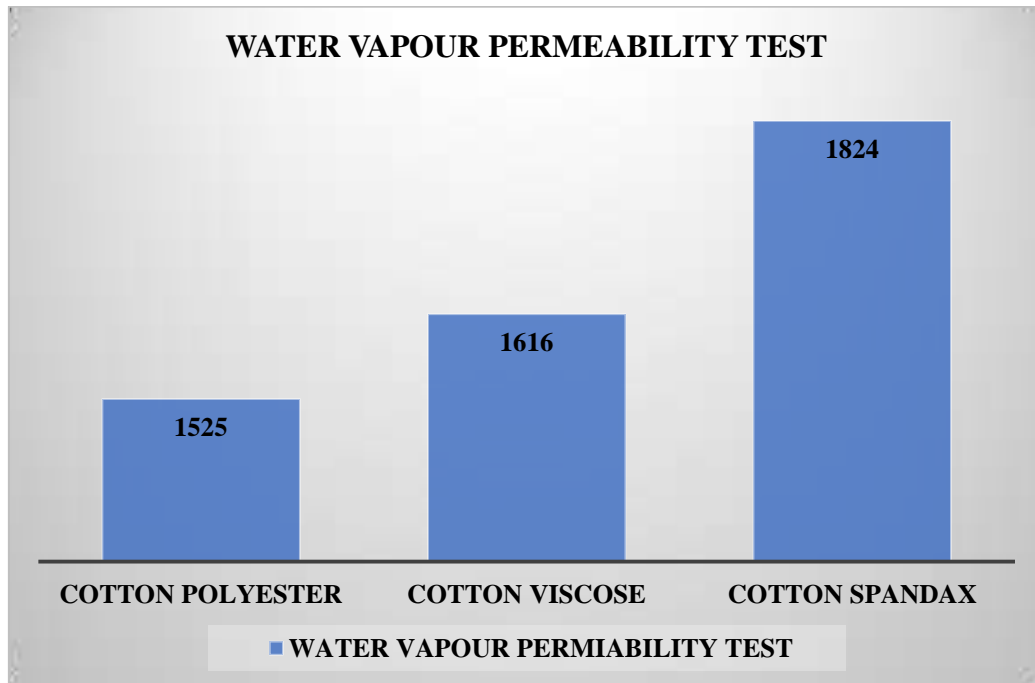


Figure.8. water vapour permeability

CRIMP

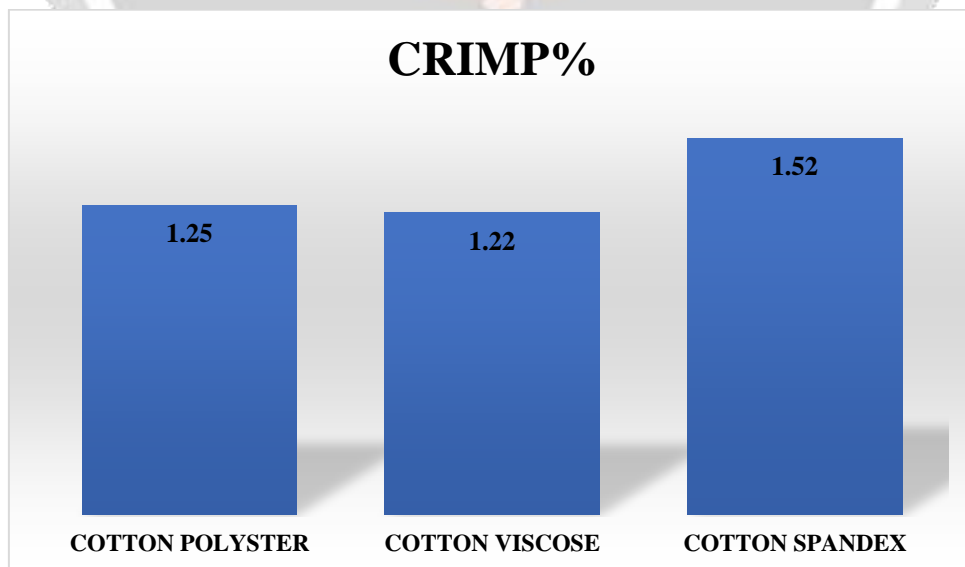
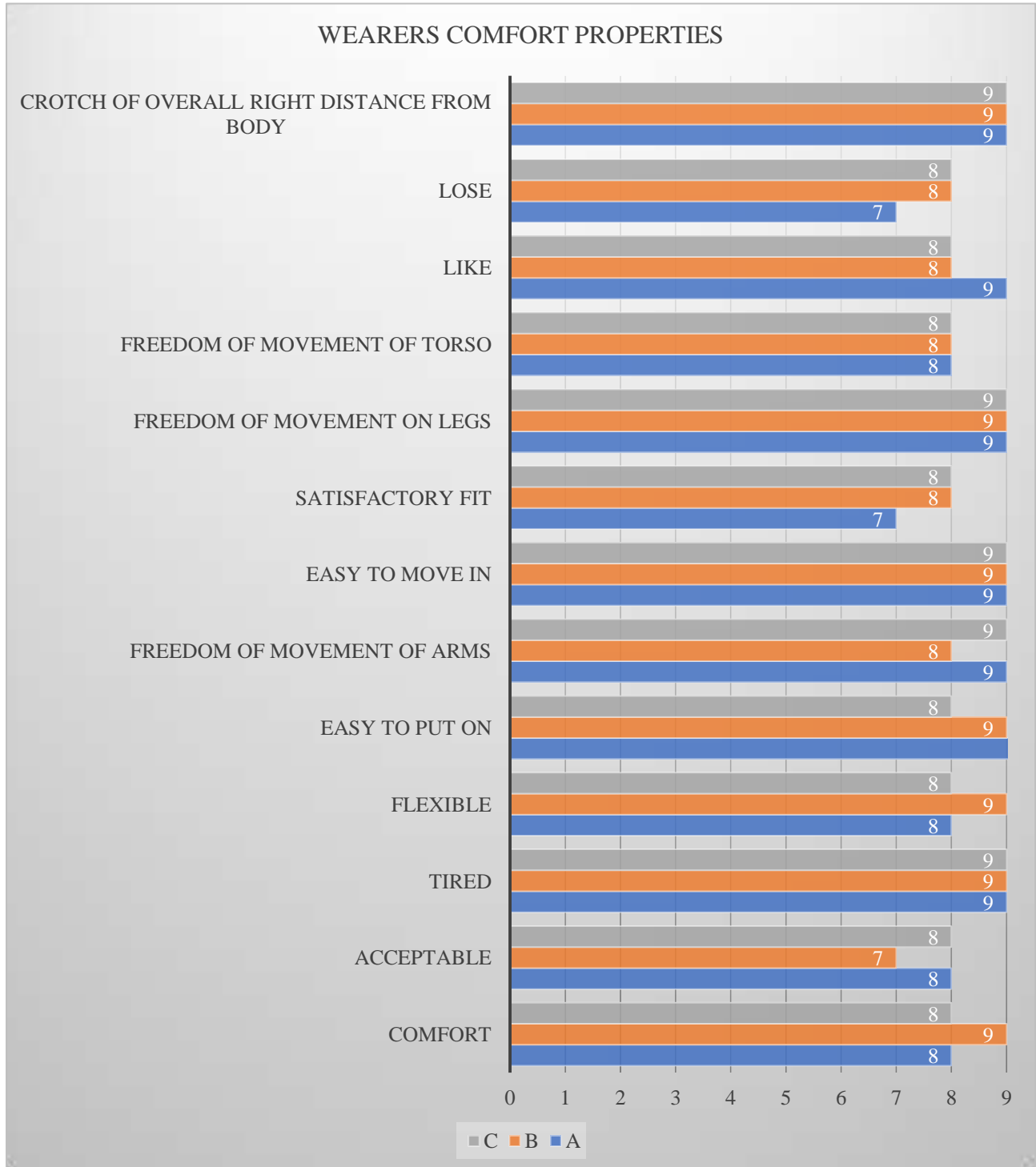


Figure.9. crimp%

To measure the yarn crimp two values must be known, the cloth length from which yarn the is removed and the straightened length of the thread. To straighten the yarn, some amount of tension must be applied just sufficient to remove all the crimps without stretching the yarn. And repeat 5 times and compare with cotton polyester, cotton viscose, and cotton spandex to find the best one. By comparing with other fabrics cotton spandex has a high crimp percentage due to fiber stretch.

GARMENT COMFORT PROPERTIES

- We have tested for 3 men’s (A, B, C) and they practiced katha and kumite for a hour and asked them about the wearer acceptability scale after completing range of body movement .
- Based on nine point scale consists of descriptive adjective sets to determine how subject felt and also how they perceived the fit and comfort of their clothing.



FINAL GARMENT

- Karate gi is designed with new design with front yoke, pit hole to get proper permeability to the garment
 - Light weight garment which has good air permeability for wearer
- Karate gi trowser has special 2 features that cuts and waist changes gives best feel to the wearer
- Gives crush effect with cross cut in the waist to tie the knot

- Given some pant yoke for freedom of movement

CONCLUSION

It's proven by this research that there are some issues with the Karate GI which need improvements incorporating current technology. Scientists are experimenting to develop player's performance where compression garment is one of the valuable concepts. However, karate players don't have any high-performance wear mainly because of the restrictions in karate GI. Therefore, in this research, it is explored a functional requirement to the garment which comprised of safeguards and gradient print panels which provide gradual compression for specific body parts of the karate player. In sport wear, groin area could be molded to achieve smooth three-dimensional shapes. Further, instead of spandex mix fabric, high modules fabric which has more compression and recovery properties could be used with moisture management finishes applied. So, we have tested the fabric in three blending proportion of fabric to fulfill the functional requirements of garment.

Different yarn is purchased in three blended ratio of cotton 60% viscose 40%, cotton 60% polyester 40%, cotton 60% spandex 40%. And we have convert them into an fabric with less GSM of 200, with same count of 20s. and we had tested the comfort properties of water absorption by sinking time, water absorption by static time, longitudinal wicking, wettability, Tensile strength – (weft width wise Newton, warp length wise), Tearing strength – (weft width wise Newton, warp length wise), Air permeability cm³/sec/cm² for 50 min, approximate thread density, Weight gm/m², Thermal conductivity (W/mk), Abrasion resistance in 50000 cycles, Shrinkage of fabric in percentage – warp/wise (lengthwise), weft wise (widthwise), water vapor permeability (water method) in g/m²/day (min), pilling after 5 hours of test in minuets, crimp % is identified and compared with cotton polyester, cotton viscose, cotton spandex. By resulting that cotton viscose has high functional performance. Thus, we have produced a garment for identifying the comfort-ness of the wearer. Karate gi is designed with new design with front yoke, pit hole to get proper permeability to the garment and Light weight garment which has good air permeability for wearer. Karate gi trowser has special 2 features that cuts and waist changes gives best feel to the wearer, Gives crush effect with cross cut in the waist to tie the knot, Given some pant yoke for freedom of movement. Thus we have tested for 3 men's and they practiced katha and kumite for a hour and asked them about the wearer acceptability scale after completing range of body movement . And asked them to tick nine point scale consists of descriptive adjective sets to determine how subject felt and also how they perceived the fit and comfort of their clothing.

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