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Protective, Comfort and Aesthetics Needs of Indian Male Riders for Motorcycle Clothing

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***Abstract*: The author assessed the motorcycle riders' clothing by investigating the fit, mobility, comfort, protection, and donning /doffing expectations for motorcycle protective clothing using a mixed-method design study. Data was collected from 55 male Indian motorcycle riders, of mean age 27.7 years, mean height 5.6' and mean weight 70.4 kgs, from 5 metropolitan cities (New Delhi, Bangalore, Mumbai and Lucknow) of India. FEA (Functional, expressive and aesthetic) Model was used to analyse responses regarding the satisfaction of clothing needs of an average male motorcycle rider in India. The result mainly reported functional considerations for the clothing design, but the motorcycle riders also suggested several expressive and aesthetic obligations. The author found that motorcycle riders needed improvements in their clothing's fit, sizing options and design in relation to mobility, comfort, protection, and durability. Motorcycle apparel manufacturers could improve their protective clothing design by integrating this study's results, leading to better protection of motorcycle riders and fulfilling their needs and expectations.**

***Keywords*: Functional clothing, Protection, Comfort, Aesthetics, Motorcycle Rider, Motorcycle clothing, User-centric design.**

1. Introduction

Motorcycling is not only a growing sport but also one of the most prominent modes of transport in South Asian countries as it offer many benefits for personal mobility: less congestion, time gain, energy savings, easier parking. But unfortunately, while riding a motorcycle, a motorcycle rider is susceptible to significantly less protection from his vehicle and most of the times gets very easily thrown away during an accident. This is mainly due to the fact that a vehicle shell like other motorised vehicles, does not protect motorcycle riders. For a motorcyclist, the road fatality risk concerning the distance travelled is 35 times higher than a passenger travelling by car (NHTSA), 2012). Also, in India, it was observed that motorcycle has the highest percentage share of road accident among all road users (Mondal, Dalela, Balasubramanian, Sharma, & Singh, 2008).

There is ample of literature that documents incidents where the death or the degree of injury could have been prevented or reduced if the rider would have worn protective clothing. Over the past 30 years, motorcycle protective clothing is successful in prevention of injuries (Feldkamp, et al 1976; Zettas et al, 1979; Hurt, Ouellet & Wager, 1981; Schuller et al., 1982 & 1986; Otte & Middelhauve, 1987; Hell & Lob, 1993; Otte et al 2002; ACEM, 2004). By wearing appropriate motorcycle protective clothing, about 43% (soft tissue) to 63% (deep extensive) injuries can be prevented (D. Otte et al., 2002; ACEM 2004; Liz de Rome, et al., 2011(a); Liz de Rome, et al., 2011(b) & Meredith, Brown and Clarke, 2015).

But in India the motorcycle riders are rarely seen wearing any protective clothing. The most common reason stated by the Indian motorcycle riders for not wearing the protective jacket and trouser is the riders' perceptions that they are bulky, uncomfortable and unfashionable add weight and restrict movements and interfere with the performance of the motorcycle riders. Also, more importantly if the motorcycle rider is wearing a protective clothing that does not fit well (not appropriate to the target body size), the impact protection zones of the motorcycle protective clothing do not lie against the body of the rider and the impact generated during a fall of the rider will not be absorbed or dissipated appropriately leading to higher risks of injury, hereby defeating the whole purpose of wearing protective clothing.

Hence, it puts in front of the designers a challenge for developing attractive model design for motorcycle protective clothing with a better dimensional and shape fit according to the Indian body shapes and wearing comfort for optimal freedom of movement. The purpose of this study to assess the needs, the wants and the issues the Indian motorcycle riders feel while wearing these protective clothing. In addressing this subject the researchers will contribute to the limited literature on apparel needs related to fit, mobility, comfort, protection, and donning and doffing of the motorcycle protective clothing.

2. Conceptual Framework

In this study, the authors applied Functional, Expressive, and Aesthetic Consumer Needs (FEA) Model, proposed by Lamb and Kallal's (1992) to assess the motorcycle protective clothing (Figure 1).

The FEA model constitutes the following components:

1) The User is the focal point.
2) The surroundings of the user are important.
3) The design criteria are confirmed by the researcher in the initial stage.
4) The final output must align with the design criteria.

The FEA models helps in understanding the target consumers cultural beliefs, sociological ideas and personal values and is an

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effective way of producing garments for a target market (Agbo A. D. & Igbo A. C., 2017). It classifies the requirements for the design as Functional, Expressive and Aesthetic aspects. The FEA model has been previously successfully used for multiple functional apparel studies, like women's sailing apparel (Bye & Hakala, 2005); hospital gowns (Cho, K. 2006); young male tennis players (Jin & Black, 2012); clothing needs of adolescent girls with disabilities (Stokes & Black, 2012); golf wear for mature women (Chae & Evenson, 2014); female chef's jacket (Black, Freeman & Rawlings, 2018) and Rock climbers' Pants (Michaelson, Teel & Chattararaman, 2018). Hence, the authors used functional aspects of the FEA Model for the development of the survey in this study.

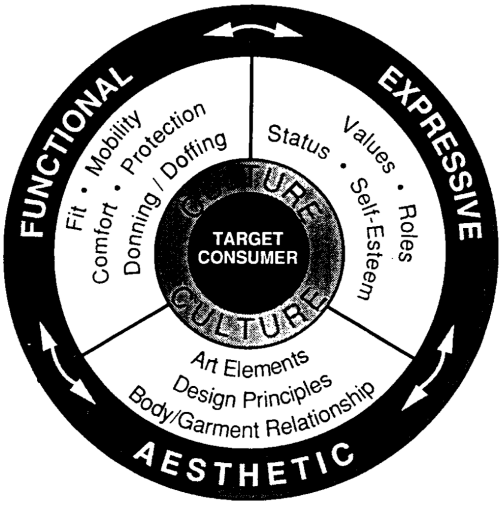

Fig. 1. The FEA consumer needs model (Lamb and Kallal, 1992)

Functional considerations for motorcycle clothing comprise of protection, level of satisfaction with the garment fit and comfort, and ease of movement. Aesthetics may involve the overall appearance; fashion ability and it determines the acceptability of the products (Carroll, 2001). Hence, in assessing motorcycle clothing, the protection, fit, mobility, comfort and the aesthetic needs of motorcycle riders were analysed based on their experiences with their existing protective clothing.

3. Motorcycle Protective Clothing

The main function of motorcycle protective clothing is protection. This protection is not only from accident-related injuries but also from the weather conditions such as the rain, sun and wind. But the motorcycle rider needs to wear the right type of safety gear while riding a motorcycle. Whether it is used for recreation or during particular competitive motorcycle activities, such clothing need to satisfy a list of criteria to ensure appropriate body protection and perfect fit according to the body shape and dimensions during dynamic wearing conditions. Despite of the importance of wearing motorcycle protective clothing while riding a motorcycle, accident statistics have remarked that relatively few riders wear full motorcycle protective clothing (ACEM, 2004 and Liz de Rome, 2004). However, it must be noted that no motorcycle protective clothing that is currently into existence can claim to be protective hundred per cent. The protective clothing for a motorcycle rider generally includes jackets, gloves, boots, and pants (Figure 2).

Fig. 2. Motorcycle protective clothing

Motorcycle clothing is made mainly of leather or textile materials. Leather clothing is more durable but makes it impossible for human skin to breathe during hot climatic conditions. Analogously to barrier clothing, heat exchange with the environment is hindered, which can have a negative impact on the motorcyclist – not only in physical, but also in mental terms (Zwolinska, M., 2012).

4. Functional Aspects of Clothing

Clothing designs should be user oriented to meet the end users' consuming need: functionality, wearability and desirability (Ross, T. A. 2017). Functional clothing is user-requirement specific and designed or engineered to meet the performance requirements of the user under extreme conditions. User's needs and requirements play a very important role design and engineering of functional clothing (Gupta, D., 2011). In one of the research published by Markhan & Lee, 2013 it was assessed that about 18-47% of the consumer goods introduced in the market, one major contribution to the product failure is poor understanding of user's needs (Markhan & Lee, 2013).

Although there appears to be no published research regarding clothing preferences and satisfaction of Indian male motorcycle riders, other research on clothing for functional work gives clues about characteristics contributing to satisfaction with different uniforms. Choi and Ashdown (2002) categorized movements for female pear pickers in five body postures. The study suggested that for improved work efficiency the clothing worn during working should allow freedom of movement. In another study by Mullet (1984), the needs of the athletes' sports clothing was evaluated to increase the effective ness of the performance and reduce the unnecessary cognitive load on the athletes. While conducting a study on female inline skaters fit and comfort were proposed as two important measures that influenced contentment with functional clothing and help to improved performance (Dickson and Pollack, 2000).

A. Protection

Hazards to a motorcyclist can be physical, impact, abrasion and environmental. While the motorcycle protective clothing

does not protect the rider from very high impact injuries like fractures and bone dislocations, it can prevent and reduce soft tissue injuries (cuts, abrasions, exhaust pipe burns, friction burns and DE-gloving) in case of a motorcycle accident. It may also help in reducing wound contamination and consequent complications in the healing of severe injuries by reducing the risk of contamination of wounds (e.g. Schuller et al, 1986, Pegg & Mayze, (1983), Hell & Lob, 1993). Generally, a motorcyclist wearing a protective gear on an average spends 7 days lesser in the hospital than the one not wearing it (Schuller et al, 1982). It is 40% less likely for a protected motorcyclist to have permanent disabilities when compared to a non-protected rider (Schuller et al, 1986).

B. Comfort

In both professional and recreational sport, comfort of the wearer is considered an integrated part of performance sport clothing. Few clothing is sold in both sport and industry for its alleged ability to improve comfort and reduce heat stress via "wicking sweat away from the skin" (Wickwire, J., et al, 2007). But wearing motorcycle protective clothing is considered a taboo by many motorcycle rider's especially during hot weather conditions as the clothing acts as a barrier to the evaporation of the sweat generated due to the body heat of the rider, which increases the discomfort of the rider due to a lack to release of excess body heat.

Motorcyclist's safety on the road depends on his/her psychomotor skills, which are in turn influenced by their body's thermal comfort. Thermal comfort of a clothing system is the dynamic thermoregulatory response of the body with its clothing and the environment. Both heat and moisture transmission characteristic of the clothing system have an important role in maintaining the thermo-physiological comfort of the wearer and reducing the physiological strain (Liz de Rome, et al., 2015).

C. Fit

A wearers' fit perception is defined from how the garment adapts to the body. It usually varies based on the body type, shape, structure, gender, age, ethnicity, lifestyle, etc of the wearer (Michealson, D. et al., 2018). The garment should hang on the body without any pull, sag, twist and nor should it hold back the wearer during any body motion (Boorady, 2011). Psychological comfort, physiological comfort and the range of motion of the wearer can directly impact his perceived fit (Das and Alagirusamy, 2010). The fit of the clothing is an important attribute as no matter how well the fabric is designed and engineered to have optimum values of heat, moisture or air transmission but if the clothing produced from the fabric does not fits the body properly it will not be considered comfortable by the wearer. A good fit of a garment depends on the relationship between the size of the wearer and the size of the garment. Size and the design of the garment are two important aspects on which the comfort of the clothing depends (Huck, J., et al., 1997). The fit of the garment and its size directly influence its comfort characteristics. A badly fitted garment may cause various discomforts like skin irritations which may result in unpleasant thermal and moisture conditions in the microclimate of the clothing and the body. If a garment restrains or binds the wearer, is too small or too small it will restrict the wearer mobility and will adversely affect the level of protection (Huck, J., et al., 1997) for example if the crotch length of the riding pant is too loose for the motorcyclist it will prevent the motorcyclist from walking quickly or can get caught between any moving part of the motorcycle. Now if the crotch is too tight it will burst open while the motorcyclist is getting on or off the motorcycle and leave him vulnerable to injuries in case of a motorcycle accident. More importantly the protective garment should be easy to wear and take off.

D. Aesthetic

Clothing and fashion might have come into existence almost a century apart but today one cannot be justified without the other. But designing functional clothing is a very challenging space; it can be easily compared to product designing. Wheat and Dickson (1999) in their study indicated that aesthetic attributes of a clothing is essential in making the first sales decision by the buyer and for overall success of the garment as if the garment was never picked up by the customer from the market shelf its product lifecycle certainly dies at that point. Particularly for motorcycle protective clothing, as it is not just about the level of protection the motorcycle protective clothing is going to give the wearer but also about the fashion statement that the wearer will make while wearing his/her gear, either on or off his/her motorcycle.

In 1995 Watkins differentiated the normal process of clothing and fashion designing from the functional clothing design where an in-depth evaluation of user needs along with direct observation, interviews and technical testing is required. But it should be remembered that design or aesthetics is a means of catching attention and achieving a positive response from the observer who in no time can be converted into a potential customer mostly by just the visual feedback of the product. Sure the functionality has much more important role of holding on the customer when it comes to functional clothing but these visual attractions and the psychophysical reactions that arise from those visual aspects to play a very important part when it comes to accepting or rejecting a product at the first sight. Hence aesthetic design can in a major way control the success or failure of a clothing system. As it is always the user acceptability and product adoption first then only the other functionalities like comfort protection come into the play.

It has already been proved that fashionability also affects the way protective clothing is perceived (Seymour, S., 2010). It becomes very important for the clothing system whose purpose is to provide protection while maintaining comfort and efficiency, it must include the right balance of fashion, trends, cultural aspects and aesthetics, as otherwise acceptability among the users can also become a challenge. Hence a successful design must incorporate the below properties-

a) It should be fit for the purpose and meets the industry standards.
b) Meet the functional requirements.
c) Must be appropriate for the task along with being

aesthetically pleasing at the same time.

d) Is acceptable to the user in terms of culture, tradition, specification etc.

There is still a lack of motorcycle protective clothing that is fashionable and convenient for general motorcycle riders (De Rome L., 2006) Motorcycle Protective clothing can be very expensive and aesthetics can play a unique selling point as maybe the aesthetic can promote the perceived protective features of the protective clothing that can draw the motorcyclist to make the purchase choice.

5. Methods

A. Sample and Description of Sample

In the experiment, 55 Indian male motorcycle riders aged 19 and above participated. Eligibility requirements for the participation were that the participants should have 1+ year motorcycle riding experience and should own atleast one of either a motorcycle protective jacket or a trouser or both. Each potential participant was provided with brief information about the study, their roles and rights, and asked to confirm their understanding and give consent before starting the questionnaire. Each participant took about 20 to 25 minutes to complete the survey.

B. Data Collection

For efficiency and effectiveness of data collection, the questionnaire was divided into four sections. This study was conducted using an online survey questionnaire with close- and open- ended questions to identify the needs in motorcycle protective clothing related to (1) demographics of the users; (2) motorcycle riding conditions; (3) opinions about the currently owed motorcycle protective clothing (4) functional, expressive, and aesthetic design characteristics.

In the first section, participants provided demographic data and information about their riding experience. The second section measured the riding conditions and their experiences while riding a motorcycle. Open-ended and forced-choice questions were used to elicit responses for these issues. In the third section, the participant's perception towards the key attributes of their current riding clothing; its utility features; the fit; the quality etc. In the last section, the participants ere asked for their design recommendations regarding the colour material and trims. The aim of this section was to facilitate the design and development of functional motorcycle clothing.

6. Results and Discussion

A. Demographics

Survey received a total of 63 online responses, out of which 8 response were incomplete, which were later removed during cluster analysis. A total number of 55 male motorcycle riders participated in this study. They ranged in ages from 20 years to 42 years. The body weight of the participants ranged from 65 kgs to 95 kgs with a mean of 72 kgs. Participants reported their height from 5'3" to 5'9" with a mean height of 5'6". The length of their participation in motorcycle riding ranged from 2 to 18 years with an average riding experience of 5.4 years. Most of the motorcycle riders (n=38, 69.10%) were postgraduates by education with an average yearly salary between 11 to 20 lakhs per annum.

B. Riding Conditions

The majority of the motorcycle riders rode all year (n=40, 80%). Motorcycle riders (n=42, 76.3%) currently owned and rode motorcycle above 350cc of which there (n=6, 11%) were above 1000cc. 70% (n=39) of the respondents were a part of a motorcycle club. 60% (n=30) of the respondents had met with a past crash within last 6 months. Motorcycle riders (n=15, 27%) reported not wearing proper protective clothing during the crash, which lead to many lacerations and serious hospitalization for 6 months. Average speed of riding on urban roads was reported to be between 40-60 km/hr by 58% of the riders but 54.5% of the riders reported an average speed of 60-100km/hr while riding on the highway with 4 motorcyclists reporting a speed higher than 130 km/hr while riding on the highways.

C. Clothing Satisfaction with the Motorcycle Protective Clothing

1) Protection expectation of the motorcycle protective clothing

Motorcycle protective clothing does not protect the rider from very high impact injuries like fractures and bone dislocations; but it can prevent or reduce soft tissue injuries in case of a motorcycle accident. The participants were asked questions about safety, durability and protection based on their own experience with their current motorcycle protective clothing 70.9% of the total motorcycle riders agreed that their current protective clothing will provide them safety in case of an accident but almost half of them (43.6%) were not sure if they were durable as they never met with an accident while wearing them hence they were still to test them in actual conditions. But, 65.5% of the motorcycle riders agreed that wearing their protective clothing did give them a sense of psychological affirmation of protection and that they will be safe in case of an accident (Table 1).

Table 1
Satisfaction with protective considerations

Garment Type	***Motor Cycle (MC) Jacket***					
Criteria	Dissatisfied		Neutral		Satisfied	
	f	*%*	*f*	*%*	*f*	*%*
Safety	6	10.9	10	18.2	39	**70.9**
Durability	11	20	24	**43.6**	20	36.4
Psychological Affirmation	6	10.9	12	21.8	36	**65.5**
Garment Type	***MC Pant***					
Criteria	Dissatisfied		Neutral		Satisfied	
	f	*%*	*f*	*%*	*f*	*%*
Safety	4	7.3	7	12.7	44	**80**
Durability	21	38.2	9	16.4	25	**45.5**
Psychological Affirmation	5	9.1	18	32.7	32	**58.2**

While answering the other questions about protection, all the riders (n=55) agreed that they wore motorcycle clothing for safety but ironically only 52% of the riders reported wearing motorcycle clothing every time they rode a motorcycle. 73% of

them reported "weather too hot" as a reason for not wearing the clothing followed by "riding a very short distance" and "it is too bulky and there was no storage space to store the clothing after the ride."

70% of the riders relayed on the internet for recommendation of motorcycle gear before buying them, while 40% of the riders relayed on their friends and family to help them buy motorcycle clothing. Majority of the riders (n= 38, 70%) were not aware of risk/protection zone on the body. Motorcycle riders (n=15, 27%) reported not wearing proper protective clothing during the crash with lead to many lacerations and serious hospitalization for 6 months.

"Eight Fractures including Femur, tongue got cut and hospitalization for 6 months was wearing helmet only."

"Happened when I wasn't wearing protective clothing. Crashes did not involved fractures. But a ligament tear once and rest bruises on legs, shoulders, chest and arms at different times."

Hence, the important factors deciding the injury protection functions for motorcycle clothing are:

- Strength of materials in terms of abrasion, cut, tear or burst resistance. The preference has been given to the leather mainly because of its high abrasion resistance. But unfortunately, due to the Indian weather conditions leather was considered best fit by the riders rather they preferred textile clothing. Hence textile garments may be constructed in multiple layers of fabrics in order to meet the requirements of the standards.
- Burst strength and coherence of seams and fastenings should be verified so that they do not rupture during an accident.
- Respondents also raised night visibility as an important concern. Some riders suggested that the placement of the reflective tapes were not appropriate as they were based on the standard standing body posture rather than the motorcyclists riding posture.

2) Comfort expectation of the motorcycle protective clothing

Some of the most important needs of the motorcycle clothing were found to be relevant to functional aspects such as comfort, fit, breathability and sun protection Not surprisingly, the motorcycle riders commented on the thermal comfort issues related to riding their motorcycle in the Indian climatic conditions (Table 2). 83.6% riders reported the riding clothing becoming soaking wet due to the perspiration in hot and cold weather. Paradoxically color of the clothing was considered to attract more heat, yet, given a choice most of the riders choose to pick dark colored clothing to prevent it from getting dirty by the heavy dust and also too bright clothing will attract unwanted attention while riding on the road. Some riders also mentioned the restriction to mobility due to the bulk of the clothing. Fit issues affecting the comfort of the riders were also reported by the respondents (69.1%). The riders suggested extendable knees in pants for reducing the restricted mobility. Some riders suggested paddings in the seat region to prevent soreness. Well-fitting garments give consumers positive outcomes, such as higher confidence about the increased nature for protection the garment will offer and in turn result in improved psychological and higher level of performance and increased ride quality of the motorcycle rider. The respondents reported that they wore the clothing for an average of 4-5 hrs per day. The riders also reported Droning and Doffing of the protective clothing before and after the ride as unsatisfactory. 72.7% riders found doffing of their motorcycle pants as more difficult than their jackets (52.7%). Almost half of the riders (45.5%) found droning of the motorcycle jackets much easier than droning of the motorcycle pants (21.8%).

Table 2
Satisfaction with comfort considerations

Garment Type	***MC Jacket***					
Criteria	Dissatisfied		Neutral		Satisfied	
	f	*%*	*f*	*%*	*f*	*%*
Heat Stress	50	**90.9**	3	5.5	2	3.6
Cold Stress	11	20	2	3.6	42	**76.4**
Wet Stress	46	**83.6**	6	10.9	3	5.5
Fit	38	**69.1**	10	18.2	7	12.7
Ease of Droning	20	36.4	10	18.2	25	**45.5**
Ease of Doffing	29	**52.7**	14	25.5	12	21.8
Garment Type	***MC Pant***					
Criteria	Dissatisfied		Neutral		Satisfied	
	f	*%*	*f*	*%*	*f*	*%*
Heat Stress	42	**76.4**	1	1.8	12	21.8
Cold Stress	8	14.5	0	0	47	**85.5**
Wet Stress	33	**60**	6	10.9	16	29.1
Fit	39	**70.9**	2	3.6	14	25.5
Ease of Droning	33	**60**	10	18.2	12	21.8
Ease of Doffing	40	**72.7**	5	9.1	10	18.2

Hence, the important factors deciding the comfort functions for motorcycle clothing are:

- Providing insulation during cold temperatures and appropriate ventilation in hot temperatures.
- The openings (neck, wrists and waist), coverage of zippers, seams and other fastening points should be designed to prevent wind entry and heat loss and also they will provide ease of droning and doffing of the clothing.
- Waterproof breathable fabrics seams, pockets, cuffs and neck openings to protect the rider from rain without sweating.

3) Aesthetic expectation of the motorcycle protective clothing

Investigating desires and preferences of the motorcycle riders is important to create specific design aspects of their clothing. The riders were asked questions regarding their satisfaction with functional consideration of their current motorcycle protective clothing. 60% of the riders reported that they were not satisfied by the colour of their current motorcycle jacket and 70.9% said that they were not satisfied by its overall style. 38.2% of the riders were happy with the current colour (mostly dark colour) of their motorcycle pants as they said it would get dirty frequently during their ride but 47.3% said that they didn't like the overall style of their pants (Table 3).

Most of the respondents (n= 29, 56%) preferred darker colors for their motorcycle clothing. 50% of the respondents preferred "classic undertones" as the visual attributes for the clothing. 73% of the respondents said that they would prefer same colour

for the upper and the lower garment. Further findings from this study revealed that design of pockets are another functional issue for motorcycle riders because they require a garment that allows them easy access to their mobile phones, driving licenses, toll tickets, loose cash and other important bike documents.

Table 3
Satisfaction with aesthetic considerations

Garment Type	***MC Jacket***					
Criteria	Dissatisfied		Neutral		Satisfied	
	f	*%*	*f*	*%*	*f*	*%*
Colour	33	**60**	15	27.3	7	12.7
Overall Style	39	**70.9**	11	20	5	9.1
Garment Type	***MC Pant***					
Criteria	Dissatisfied		Neutral		Satisfied	
	f	*%*	*f*	*%*	*f*	*%*
Colour	16	29.1	18	32.7	21	**38.2**
Overall Style	26	**47.3**	16	29.1	13	23.6

7. Conclusion

With the increase in the number of motorcycle riders in India, consumer awareness about motorcycle protective clothing will also increase. Hence, the manufacturers should anticipate that consumers would now look forward for protective clothing that best fulfills their needs and aspirations based in the Indian weather conditions and terrain. Ideally, the consumer will prefer more comfortable and durable protective material with breathability, improved waistband and thorax design, and crotch rise adjustments.

This study was conducted to analyze protective, functional and aesthetic needs of Indian motorcycle riders (male) clothing. The insight about the existing motorcycle clothing that the authors found in this study included poor thermoregulation of body heat and moisture, which adversely affected riders' satisfaction. The authors propose that the testing of the garments moisture permeability for better thermoregulation of body heat, abrasion resistance for impact protection, stretch for comfort may improve overall satisfaction of the user. Based on the results the marketplace for motorcycle protective clothing needs to consider various needs of the motorcycle riders. Motorcycle manufactures should improve their apparel by incorporating these results, leading to better protect, comfort and fulfillment of the motorcycle riders needs and expectations. Additionally, the functional clothing must address the wide variety of riding conditions across seasons and geographical locations as well as the changes over the course of a day. Present research is a part of a larger study aiming to establish key criteria for design and development of functional clothing for Indian motorcycle riders.

8. Future Directions

The limited sample size of participants were used in this study too assess the general needs of Indian male motorcycle protective clothing, which limits the generalization of the results. In future increased number of participants can further help to improve the results of this study.

New ways of improving protection, mobility, comfort, and aesthetics of motorcycle protective clothing should be investigated in future. Functional clothing designers could use advanced body motion sensors and 3D body scanning technologies to help them record motorcycle riders body in motion and their body measurement changes while in active positions. As, fit and sizing were problem areas well defined by the motorcycle riders, the continued gathering of body measurement data in both static and active positions is essential, so that manufacturers can use accurate body measurements while designing and developing apparel for Indian motorcycle riders. Additional research is needed to determine if the needs of the Indian male motorcycle riders differ significantly from those in other countries.

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