

## Ergonomic factors impacting bag design: a pilot study on Hajj and Umrah bags

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### Abstract:

Hajj is the largest annual gathering of Muslims, during which more than two million people from different parts of the world come together in a small region. Therefore, the idea behind this research stems from a deep interest in giving due care to Hajj and Umrah performers in line with the Kingdom of Saudi Arabia's 2030 vision, by rendering top-notch services to pilgrims. The current research aims to analyze the bags available in the local markets in light of ergonomics. This is along with identifying the factors that impact the selection of bags by Hajj and Umrah performers. The research adopts the descriptive analytical approach due to its appropriateness to fulfill the objectives of the research. The researcher conducted a pilot study that played a major role before conducting a large-scale research project as it was composed of small-sized, preliminary studies aiming at finding out whether the basic components of the main study can be achieved. The pilot study aims to identify the types of bags used by Hajj and Umrah performers, explore the problems associated with bags used, and understand the factors that pilgrims' choices. This is achieved through describing and inferring the relationship between ergonomics and bag design. Data were collected from fifty Hajj and Umrah performers through a questionnaire, according to which the factors impacting the choice and use of the Hajj bag will be identified. The researcher recommended conducting future research related to the pilot study to propose new designs for smart bags for Hajj and Umrah performers. The researcher recommends that the new bags be provided free of charge by the Ministry of Hajj as pilgrims prefer.

### Keywords:

*Hajj*  
*Bags*  
*Hajj bags selection criteria*  
*design*

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### Introduction:

Hajj is one of the pillars of Islam. The pilgrim moves about wearing his ihram clothing while being not allowed to practice matters that are permissible to him when being in ihram, including luxury and expansion. This includes also his clothes and personal belongings. In Hajj, there are conditions that must be available in the clothes of a person in the state of *ihram* in order to protect Hajj and Umrah performers from the extreme heat and make them feel comfortable during the performance of the rites (Abdul-Fatah & Madi 2015). A study by Khan & Shambour, 2018 pointed out that many governments, companies and individuals provide a wide range of services and facilities to overcome the difficulties that pilgrims may face. Also, technology has gained increasing attention as a primary means of providing these services.

Handbags are considered one of the basic

supplements, especially Hajj and Umrah bags, as they are necessary to preserve the personal belongings the pilgrims carry during most of their day while performing the rituals of Hajj and Umrah. The study problem stems from the difficulties found to be related to losing bags or overloads. This has urged both researchers to conduct a preliminary pilot study in Makkah.

The current study is consistent with what was mentioned by Farghali and Al-Dabagh, 2009 with regard to the directives of the Minister of Higher Education No. 7 / B / 5291, dated 13/3/1422 on the sidelines of the Scientific Forum of Hajj, Umrah and Visit Research proposed by the Custodian of the Two Holy Mosques Institute as an annual opportunity focusing on the provision of services to the pilgrims to achieve the security and safety of pilgrims and therefore they can perform the rituals with ease and smoothness. According to the 2030 Vision of the Kingdom of Saudi

Arabia, the Ministry of Hajj and Umrah has launched this year a package of strategic initiatives; the most prominent of which is: the launch of the electronic bracelets project, and its application to pilgrims (www.haj.gov.sa).

Accordingly, the researcher confirms the importance of studying the appropriate ergonomic design of the bags to avoid potential health problems resulting from carrying the bag for a long time as well as psychological problems resulting from the pilgrims' concern about the loss or theft of their personal belongings. Therefore, the study problem can be identified in the following questions:

1. What are the problems facing performers of Hajj and Umrah while using their personal bags?
2. What are the factors impacting the proper choice of Hajj and Umrah bag?

Moreover, the significance of this research can be described in terms of a growing interest in giving due care to Hajj and Umrah performers in line with the Kingdom of Saudi Arabia's 2030 vision, by rendering top-notch services to pilgrims since their arrival in the KSA and till their departure after being blessed with performing such sacred rites with ease and comfort. The current research aims to analyze the bags available in the local markets in light of ergonomics. This is along with identifying the factors that impact the selection of bags by Hajj and Umrah performers.

### Methodology

The study adopted the analytical descriptive method, whereby the study identifies the ergonomic needs of pilgrims performing the sacred rituals of the hajj, and visitors to the sacred places. This is because this approach is instrumental to achieve the research objectives and verify its hypotheses which have been formulated by the researcher as follows:

1. There are statistically significant differences between the design of existing bags and new bags according to the application of ergonomic considerations.

### Procedures:

1. Analysis of the ergonomic needs of Hajj and Umrah performers.
2. Designing research tools.
3. Verifying the validity and reliability of research tools.
4. Utilizing the appropriate statistical analysis to analyze the results.

### Tools:

The research tools were selected based on their appropriateness to the research methodology and its topic as follows:

#### 1. A questionnaire identifying the needs of Hajj and Umrah performers.

The researcher prepared a special questionnaire with the aim of identifying the views of Hajj and Umrah performers with regard to Hajj and Umrah bags available in the markets. To verify the validity of the questionnaire, it was first presented in its initial form to the research supervisor. Then, it was reviewed by a group of arbitrators from the faculty members of the Department of Fashion Design of the College of Art and Design of Jeddah University, in order to get familiar with their views on the research tool and the extent to which it achieved the objective for which it was set, and the availability of the following items in it (formulation and clarity of questionnaire items - sequencing and organization - number of items - inclusion of the research objectives). The percentage of agreement by the arbitrator reached (85.7%), which indicates the validity of the questionnaire, and thus the questionnaire in its final form became ready for implementation.

The two researchers applied the questionnaire to the research sample composed of (50) Hajj and Umrah performers. The sample size was selected according to the fact that the study is a small preliminary pilot study aiming at finding out whether the basic components of the main study can be achieved. The pilot study represents a simple random sample categorized under several items: namely, age (40 years and over), and gender (male or female).

Table (1): the characteristics of the study sample (n = 50)

response		variable	
percentage	Frequency		
%54	27	male	sex
%46	23	female	
%14	7	25-15 from	age
%46	23	35-26	
%30	15	36-45	
%10	5	From 46 And above	

After applying the research tools to the sample | according to the proposed research methodology,

the researcher expects that the current study will fulfill its hypotheses and answer its questions to serve the pilgrims' segment and the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research in line with the Kingdom of Saudi Arabia's 2030 vision, which aims to provide

### 3-1 Conceptual framework:

easier factors for pilgrims, to perform the sacred duty, by extensive use of the latest technological tools since their arrival in the Kingdom till completing their rites, and returning to their countries.

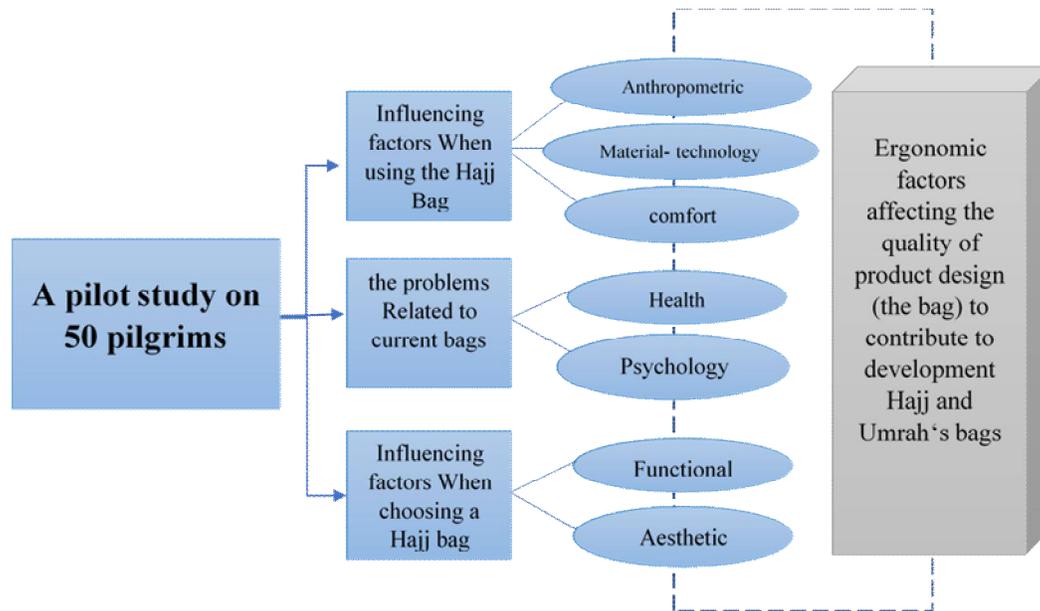


Figure 1: Conceptual framework (researcher's design)

#### Terminology:

##### Ergonomics:

**Lexically:** The term ergonomics originally comes from the Greek words *ergon* (work or labor) and *nomos* (natural laws). (Salem, 2019).

**Contextually:** According to (Farghali et al, 2016), it is "a science concerned with arranging products and processes and their appropriateness to people's abilities, traits and capacities with the aim of enhancing their lives and maximizing productivity."

**Procedurally:** In the current research, ergonomics means studying the characteristics of Hajj and Umrah performers, to benefit from them in designing to enhance the functional performance of the proposed new bags.

##### Bags:

**Lexically:** it is where food and goods are kept along with everything being carried by the traveller. (Almougem Al-Waseet, 2011)

**Contextually:** "The bag is a basic clothing supplement and an important part of the person's external looks. When choosing it, considerations related to its size, color, material and occasion should be taken into account "(Shaker & Al-Maddah, 2017).

**Procedurally:** It can be defined as one of the most important separate clothing supplements, which

have different types depending on the purpose of carrying them and owning them, and depending on how they are carried as there are handbags for the hand and others to be carried in the arm and a third type being carried on the back or the shoulder.

#### Theoretical framework:

Any scientific study must be based on theoretical backgrounds that make it balanced in its presentation. Therefore, the researcher framed the current study with the theory of functionalism. This theory is summarized by I-Shoshani, 2012 citing (Zaqzouq, 1981, 145) as follows: "that any product is originally made for scientific purposes to be performed and utilitarian benefits taken from it. Accordingly, the intended purposes are determined from the shape of the object manufactured which must be appropriate to the functions. in our modern era, the designer is linked in his designs with the user. The designer also needs to perform an effective role between both the user (the pilgrim here) and the product (the smart bag) to fulfill the largest possible design desires and economic values with the lowest affordable costs; and the product is also required to achieve the highest profit at the lowest cost (Jalila, 2011).

However, there have been perspectives against the theory of functionalism, attempting to expand the

functionalism scope to accommodate the emotional and spiritual needs of the human person affirming that both form and function are one organic entity that is inseparable and indivisible and that aesthetics is inseparable from the function (Al-Shoshani, 2012). Ergonomic aspects and human factors have gained more popularity among several researchers because of their several contributions in terms of enhancing the efficiency of use, functionality, productivity, ease of use and comfort for humans; these also include human factors, such as biomechanical factors that are concerned with studying the performance requirements of the individual body of the various

tasks (Haraz et al, 2017).

Based on what is mentioned above, it can be concluded that it is crucial to blend between design and human requirements and combining aesthetics and functionality, where the designer must follow the ergonomic rules during the design. The researcher agrees with (Al-Hibri, 2016) in her study on "the interrelationship between aesthetics and ergonomic considerations in the product design process" where she exhibited the close link between the aesthetics of the product look and the ergonomic aspects in the following manner:

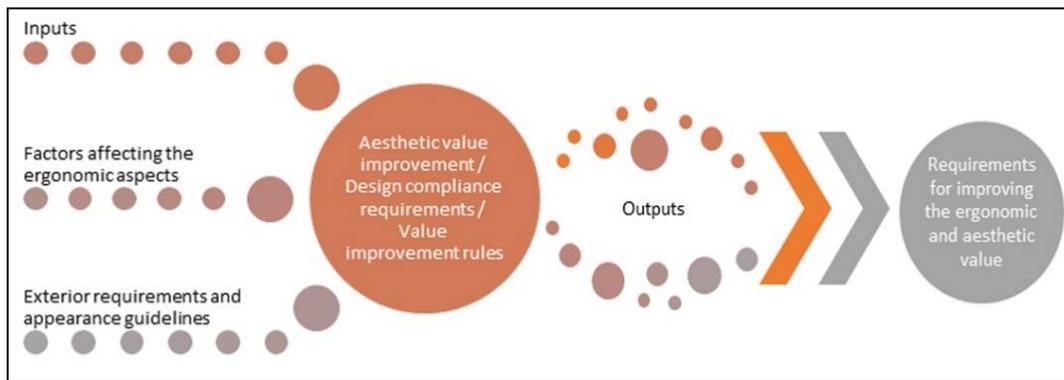


Figure (2): Requirements for the aesthetics of the look of the product and the ergonomic aspects, designed by the researcher (Al-Hibri, 2016)

The researcher comes to the question: "What about designing clothing supplement, which Hajj and Umrah performers need to keep their personal belongings?" Designing the clothing supplement is only a creative activity that includes innovative data in this field that would meet the human needs, which may be aesthetic or functional, or economical. This creative activity is a set of mental skills employed to create a suitable atmosphere for imagining or visualizing an innovative form that is subject to a process of organizing its elements in a way that creates a visual pattern in light of the accepted rules in building artwork (Al-Jawhari et al. 2014). This is in line with this research to attempt to provide a clothing item for Hajj and and Umrah performers compatible with the function of such sacred rites and thus initiating research in the field of ergonomic bag design.

The researcher notes the importance of studying the good ergonomic design of these bags to avoid potential health problems from carrying the bag for a long time. It is essential to integrate the general dimensions of human factors and ergonomics in various fields of design. A study by Combret and other, 2018 confirmed that carrying heavy bags may cause muscle and bone disorders and problems in balance. Also, Leeuwen, 2013 identified some of the problems encountering bag users. For these injuries and diseases, the term "musculoskeletal disorders (MSDs)" is used to refer to:

- Muscle strains and back injuries
- Tendinitis
- Carpal tunnel syndrome
- Rotator cuff injuries (a shoulder problem)
- Epicondylitis (an elbow problem)

) Leeuwen(2013, Table (2): shows the bag sizes and average weights when filling them

Bag size	measurement	average weights when filling
<b>small</b>	13.58 x 10.24 x 7.1 Inch 34.5 x 26 x 18 cm (16.1 Liter)	10 pounds.
<b>Medium</b>	14.2 x 11.8 x 7.1 Inch 36 x 30 x 18 cm (19.4 Liter)	28 pounds.
<b>large</b>	17.99 x 15.98 x 7.1 Inch	38 pounds.

45.7 x 40.6 x 18 cm (33.4 Liter)



Picture 1: Illustration of muscle disorders  
(<https://my.nps.edu>)

There exist several factors in terms of human movement that the designer takes into account. Most of the technologies necessary to alleviate these health concerns associated with carrying bags have already been invented and they only need to be applied. In case consumers are more aware of the weight they carry in their bags, and the type of these bags based on the objective of use, they will be more comfortable and will have a better position in the long run. What could help consumers is to make the necessary lifestyle changes to reduce loads, read product labels before buying and choosing those that match their needs (Grandin, 2011). Therefore, the general ergonomic principle here is to avoid excess effort on the 1-5-1: The first bag

muscles that can be noticed, for example when the upper limbs, especially when the wrist and hands are in inappropriate positions; this can be achieved through a good ergonomic product design. (Jalil, 2017).

### 1.5 Application framework:

There are different types of Hajj bags available in the market with a variety of brands, shapes and sizes, depending on desires and needs. However, there are still complaints from users when or after using these bags. Therefore, this study was conducted to analyze the bags used in Hajj based on the axes of ergonomics as explained by (Mustafa, 2009), namely comfort, ease of use, functionality, aesthetics, safety, productivity.

### Analysis of some of the current bags in the light of the axes of ergonomics:

As for these axes, they include the ease of movement when wearing bags that do not hinder the movement of the user as mentioned by (Salem, 2019). She mentioned the ease of wearing and taking it off, the ease of caring for the product and its suitability for the age group and the place and period when using it. Below is an ergonomic analysis of five bags available in the market or distributed for free in some Hajj campaigns:

Image		
aesthetics	Analysis	
	model	neck bag
	color	White color has been used, and the flag of Bangladesh is printed in green and red.
shape	The bag takes the square shape with straps for the neck.	
functionality	It is not functionally suitable as its size is small and does not match the size of the user or the requirements and purposes of the pilgrim and is not divided well.	
comfort	Easy mobility when wearing it.	
safety	Unsafe as it is can be cut easily during crowdedness.	

### 1-5-2 Second bag:

Image		
a	Analysis	

	model	bum bag
	color	Black color is used.
	shape	The bag takes the trapezoidal shape.
functionality	It contains several pockets and can also be used as a belt to fasten the ihram clothing while wearing it	
comfort	Easy mobility when wearing and taking it off.	
safety	The model has a front zipper, which helps the pilgrim feel safe.	

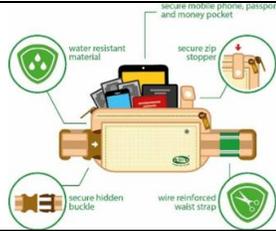
1-5-3 The third bag:

Image		
aesthetics	Analysis	
	model	messenger bag
	color	Black and white colors are used for the logo.
	shape	The bag takes the triangular shape which is usually adopted for Hajj bags.
functionality	It does not contain enough or hidden pockets.	
comfort	Having a bag strap for one shoulder can cause pressure on the muscular system.	
safety	It is unsafe as it can be easily opened, so the pilgrim can be robbed of his belongings.	

1-5-4 Fourth bag:

Image		
aesthetics	Analysis	
	model	Drawstring Bag
	color	Beige, brown and green colors are used in designing the logo.
	shape	The bag has a cylindrical shape that is not used with the Hajj bags.
functionality	It is disorganized and does not have enough or hidden pockets.	
comfort	Backpacks are comfortable to shoulder when in use, but being carried on the back makes it difficult to reach belongings.	
safety	It is unsafe as it can be easily opened, so the pilgrim can be robbed of his belongings.	

5-5-1 The fifth bag:

Image		
aesthetics	Analysis	
	model	Belt bag
color	Beige, brown and green colors are used in designing the logo.	

shape	The bag has a rectangular shape.
functionality	The possibility to use it as a belt for ihram and having the bag on the front of the body makes it easier and faster to reach belongings. The bag also contains hidden pockets.
comfort	Easy mobility when wearing the design and it is made of waterproof material.
safety	It is considered somewhat safe because it is cannot be easily cut and it contains a zipper.

### Results and discussion:

Designing bags is based on information in the first place, so when designing bags for the pilgrimage, the designer needs a big volume of information related to the user in terms of anthropometric information and the limits of movements in addition to physiological and psychological aspects. The designer utilizes this information during the design stage and thus helps

him fulfill the needs and requirements of the pilgrims. The data included in the questionnaire was analyzed to obtain frequencies, ratios and descriptive statistics. In a pilot study like this one, the given accounts and statistics formed a sufficient background to answer the study's questions, with which the use of additional statistical operations was not necessary. The results of the analysis came as follows:

Table (3): Frequency and percentages of the questionnaire items according to the opinions of the research sample (n = 50)

Questions		Response			
		no		yes	
		%	f	%	f
1	Is it easy to find a suitable bag on the market that caters to pilgrims?	%44	22	%56	28
2	Do you feel satisfied with the design of the bags on the market that can be used for Hajj and Umrah?	%56	28	%44	22
3	Are the bags on the market designed in a way that supports ergonomic?	%66	33	%34	17
4	Do you navigate during the different Hajj rituals with your identification documents?	%26	13	%74	37
5	Have you been robbed in Hajj and Umrah) at least once) ?	%82	41	%18	9
6	Have you been lost in Hajj and Umrah) at least once) ?	%58	29	%42	21
7	Have you lost your personal possession in Hajj and Umrah at least once?	%72	36	%28	14
8	Do you feel comfortable using the bags that are distributed free from the companies and the Hajj campaigns?	%60	30	%40	20

The study revealed that more than half of the respondents did not feel comfortable while using the bags distributed free of charge by the companies and the pilgrimage campaigns, as it was clear from the analytical study that both researchers found this type of bags is not appropriate in terms of material, performance and safety. Furthermore, 44% of the responses stated that it is not easy to find a suitable bag to serve the pilgrims' category. This is what made both researchers -in the first place - to study the factors that help pilgrims choose their bags.

The study showed that 56% of the pilgrims are not satisfied with the bag designs available at the market. Also, 66% of respondents believe that the

bags at the market do not support ergonomic considerations - ergonomic considerations are explained in the introduction to the questionnaire - whereas 34% of them believe that some of these bags match good ergonomic design considerations.

With regard to feeling safe, the study shows that 28% of pilgrims have been exposed to losing their personal belongings for at least once, while 42% of them have already been lost for at least once. The study conducted by (Abhang and others, 2018) has proposed a new technology with a one-touch system using GSM so that the person does not feel helpless while facing such problems or social challenges such as stealing the bag or losing

it. Since 74% of respondents - a high percentage - carry their own identification and cash while touring Mecca and performing different rituals of Hajj and Umrah, both researchers stress the necessity of providing a safety factor in the pilgrims bags as in the study of Matthews and other, 2018 where a three-dimensional bag and a tracking device for luggage is designed to avoid theft in addition to sending an alert notification whenever any of its contents is removed. In spite

of the fact that only 18% of respondents have been robbed of their belongings - for at least once -, this problem must be taken into consideration. This is what the researcher will utilize in the future studies when designing a smart bag for pilgrims, that is, to the best of our knowledge, has not been included in the previous literature in terms of providing comfort and safety for visitors to the Holy Mosque.

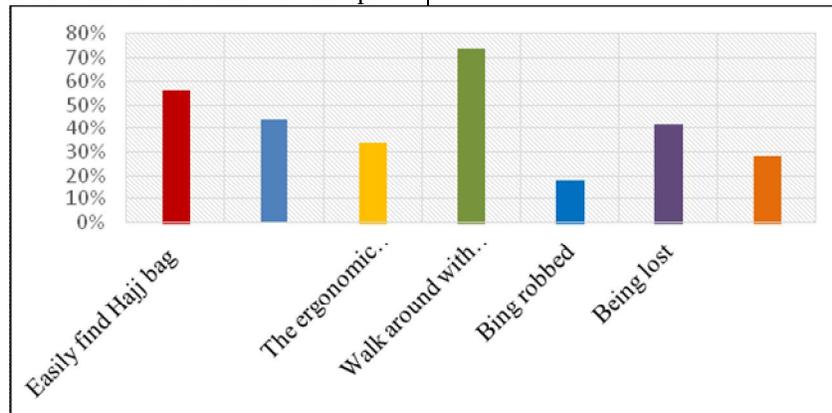


Figure (3): shows the percentages of the questionnaire items according to the opinion of the research sample

As for the question about preferences (in general, what are the specifications of the bag that you would like to carry during the Hajj and Umrah rites?), the most important suggestions came as follows:

1. The majority of the sample suggested preferences regarding the size of the bag, such as being lightweight, easy to carry, and of small size. They prefer not to use bright colors that do not match the Hajj environment.
2. The pilgrims unanimously agreed on the importance of having several pockets devoted to identification, cards and banknotes, where others prefer that such clothing should have pockets for water or juice and leftovers.
3. The high-quality materials should be used when fabricating bags in order to protect the bearer from suffering from scrapes, scratches or abrasions while being carried, due to the body temperature during the performance of the rites. The choice of tissue, as suggested by a study by (Grazyna and other, 2016), is an important factor affecting physiological and sensory comfort.
4. Some members of the sample suggested that they be completely closed and connected with the mobile phone in order to prevent theft. According to a study by (Gindi and others 2016), a smart bag consisting of a digital lock that cannot be opened without using a secret

code is a good suggestion.

5. The pilgrims' opinions differed regarding the type and design of the bag, as some expressed their desire to be a backpack, while others suggested that it be a front bag or a waist bag to fasten the Ihram clothing while being worn. Selecting the right bag model is crucial. For instance, (Christopher and Faisal, 2017) confirmed that ergonomically designed backpacks that are uncomfortable tend to cause dysfunction of the spine and bones. Additionally, (Zahiri, 2018), and his fellow researchers recommended that women in particular should avoid carrying backpacks 6% heavier than their weight for more than 16 minutes. On the other hand, (Dalia and Amr, 2018) stated that carrying a double-strap bag restores the balance of the body and head to a condition similar to a non-pregnancy. A study by (Hong and other, 2011) showed that designing the bag to place the load on the chest area successfully reduces pressure on the spine.

#### The study reached the following results:

1. Using ergonomic proportions and measurements to design Hajj bags that increase performance and design effectiveness.
2. Pilgrims' choice of bags should be consistent with ergonomic factors in terms of comfort, shape, functionality and safety in design.

## Conclusion

In conclusion, the analysis of the pilot study data conducted on pilgrims of Hajj and Umrah in the 2018 Umrah Season concluded that the important factors that must be taken into account during the design of pilgrims' bags include aesthetics and appropriate function with a feeling of safety and comfort. Based on the knowledge of these factors, both researchers will do further research and publishing on ergonomic design, as both researchers look forward to formulating a new experimental study with clearer goals and more comprehensive questions. In the near future, the researcher also plans to propose designs for smart bags for pilgrims according to the technical and functional standards extracted from the current pilot study.

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