

An Analysis on Size Suitability of Protective Masks

Jin Choi, Sun Mi Sin, and Wol Hee Do
Chonnam National University, South Korea.

Keyword: Protection mask, Life-type mask, Micro dust, Asian dust

At present, sales of protective masks, which can protect the human respiratory system primarily due to air pollution such as fine dust and yellow sand in China, and infectious diseases such as swine flu, are growing rapidly in Asia such as Korea, China, Japan and Hong Kong. Since a mask which is not suitable for a human face type has a low protection effect, it is necessary to design the shape of the mask reflecting the face shape of the human body in consideration of the size and shape of each part of the face.

According to Lee et al.(2014) reported that faces of Asians are shorter and wider than those of Westerners. It is not easy to find masks suitable to consumers' faces in the current market.

It is essential to analyze masks currently sold in each country so that consumers can choose suitable types for their purposes including accurate sizes in order to enhance the performance and effect.

The masks analyzed in this study are classified into a yellow dust mask (sanitation mask) and a Fine dust protective mask sold in four countries of Korea, China, the US and England. The standard of Korea is KF (Korea Filter, particle blocking function), which is divided into KF80, KF94 and KF99, which are certified by Ministry of Food and Drug Safety. The standard of the US is N95 that is certified by the National Institute for Occupational Safety and Health (NIOSH). The products used in the experiment of this study are unisex masks for adult including 9 products of Korea (42.9%), 2 of China (9.5%), 8 of the US (38.1%) and 2 of England (9.5%), so total 21 items. Since the measuring items for analysis of the sizes of product for fine dust are not presented in either KS or ISO, this study measured the sizes of total 10 items including 5 horizontal length items, 3 vertical length items and 2 angle items in order to easily match with faces by referring to Eom (2016) for names and titles of measuring items, and compare and analyzed. For the analysis, IBM SPSS Statistics 21 was used for ANOVA per statistics of basic, each country and each brand, and *t*-test was done for the sizes of Eastern and Western.

The shapes of each country's masks used in the experiment are as follows. The shapes of masks are classified into sectional type and solid type based on the method to enhance contact to the face. The sectional type includes darts that form three dimensional shape according to curved surface, but the solid type does not have sections but consists of flat areas. In Korea, there are the sectional type (7, 64%) and the solid type (4, 36%). In the US, most of the products are the solid type (6, 75%), but China and England have mostly the sectional type (2, 100%).

The materials used in masks are as follows. The materials of Korean and Chinese masks are polyester and polypropylene, and in the US and England, cotton is used.

The texture of masks in Korea and China is non-woven fabric, fabric in the US, and fabric and non-woven fabric in England. Regarding the use period of masks, they are disposable, which is compression of lining, surface fabric and filter, in Korea and China. However, in the US and

England, the lining, surface fabric and filter are made with dual structure, so they can be used semi-permanently by changing filters.

The result of analyzing the sizes of products is as follows. First, there was a significant difference among the products in the 3 horizontal length items of Nose-Tragion A (≤ 0.003), Lip-Tragion A (≤ 0.030), Menton-Tragion B (≤ 0.005) and the 1 vertical length item of chin-menton length (≤ 0.008). The Nose-Tragion A was the US 12.2cm > England 10.8cm > China 10.7cm > Korea 9.6cm. The Chin-Tragion B was the US 12.4cm > England 11.3cm > China 10.4cm > Korea 9.6cm, which indicated that the US and Korea showed over 2.5cm in two items. The Chin-menton length was England 8.4cm > the US 5.3cm > China 4.4cm > Korea 4.2cm, which indicated that there was 4.2cm of big difference between Korea and England. In addition, the result of comparing Eastern (Korea and China) and Western (the US and England) showed that the item of Menton-Tragion B (≤ 0.001) was Eastern 9.4cm < Western 11.4cm, which is approximately 2cm of significant difference. The above result indicates that the horizontal length and vertical length of Korean and Chinese products are smaller than those of the US and England. Easterners have higher face covering ratio, but the sizes are not suitable, so there is a possibility of low contact rate to the face.

The result of analyzing fine dust masks in the market showed that they mark the structures, forms and penetration ratio of fine dust, but there is no size standard for each size. Just as the differences in the faces of East and West were found in Lee et al (2014) study, protective masks were also found in products of the same size. Therefore, it is necessary to establish standards of each size for suitable pattern designs for face shapes in each country. A future study is intended to provide basic resources on product standardization that is involved with each country's face types and that improves the functions of fine dust masks.

This research was supported in 2018 by the MOE (The Ministry of Education), Republic of Korea, under the BK21 plus project (S18AR43D0801) supervised by the NRF (National Research Foundation of Korea).

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