# SUBJECTIVE EVALUATION OF COMFORTABLENESS OF WET COTTON AND PAPER HAND TOWELS "OSHIBORI"

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## ABSTRACT

The present study carried out a subjective evaluation experiment using "oshibori" (a small wet towel to wipe the hands or face) which were made of cotton and paper. In the experiment, 20 kinds of cotton oshiboris and 20 kinds of paper oshiboris with various sizes, weights, and textures were used. Twenty-one subjects participated in the experiment. The subjects evaluated the oshiboris in five grades based on the following properties, "comfortableness," "luxuriousness," "relaxation," "refreshingness," "volume," "moisture," "absorption," "hand-feel," and "satisfaction" after using each oshibori. As a result, the evaluation values of the cotton oshiboris were generally higher than those of the paper oshiboris on the overall evaluation terms.

## 1. INTRODUCTION

The "oshibori" (a small wet towel to wipe the hands or face) has been familiar to Japanese people since old times. An oshibori is generally served to each customer to clean the hands or face before eating in places such as restaurants, bars, coffee shops and so on. Although a number of studies have been made on the oshibori from the cleaning and sanitation viewpoints [1]–[3], there are few studies on the quantitative evaluation of the feel of the oshibori. In order to quantitatively evaluate the feel of the oshibori, the present study carried out a subjective evaluation experiment using oshiboris which were made of cotton and paper.

## 2. EXPERIMENT

We carried out a subjective evaluation experiment to investigate overall feel of various kinds of oshiboris.

### 2.1. Samples

In the experiment, we used 20 kinds of cotton oshiboris and 20 kinds of paper oshiboris with various sizes, weights, and textures. Tables 1 and 2 show the woven designs, sizes, and weights of the cotton and paper oshiboris, respectively. All cotton and paper oshiboris were unused. The cotton oshiboris were washed once to remove the paste that adhered when they were manufactured. We prepared over 50 pieces of each kind of the cotton oshibori, and selected around 25 pieces with small dispersion in weight when they dry. We adjusted the amount of moisture in each cotton oshibori to become around 2.5 times more weight than that when it dries [4]. After making the adjustment, we wrapped each cotton oshibori up in plastic and sealed it to avoid changing the moisture content of it by drying out. About the paper oshiboris, we used commercially-supplied ones as they are.

**Table 1**. Woven designs, sizes, and weights of the cotton oshiboris.

| No. | woven design | size | weight (g) | |
|---|---|---|---|---|
| | | (cm × cm) | dry | wet |
| C-1 | plain | 21 × 21 | 13.0 | 32.5 |
| C-2 | plain | 24 × 24 | 18.0 | 45.0 |
| C-3 | little check | 27 × 27 | 18.5 | 46.3 |
| C-4 | big check | 28 × 28 | 22.5 | 56.3 |
| C-5 | dobby | 28 × 30 | 26.0 | 65.0 |
| C-6 | big check | 28.5 × 28.5 | 25.5 | 36.8 |
| C-7 | plain | 29 × 29 | 28.0 | 70.0 |
| C-8 | plain | 30 × 31 | 32.0 | 80.0 |
| C-9 | dobby | 29 × 30 | 32.0 | 80.0 |
| C-10 | plain | 30 × 34 | 31.5 | 78.8 |
| C-11 | plain | 29 × 36 | 39.0 | 97.5 |
| C-12 | plain (two lines) | 31 × 35 | 37.5 | 93.8 |
| C-13 | dobby | 30 × 40 | 39.5 | 98.8 |
| C-14 | plain | 31 × 40 | 42.5 | 106.3 |
| C-15 | plain (two lines) | 29 × 36 | 43.0 | 107.5 |
| C-16 | plain (two lines) | 30.5 × 35.5 | 48.5 | 121.3 |
| C-17 | plain | 31 × 39 | 52.5 | 131.3 |
| C-18 | plain | 32 × 39 | 65.0 | 162.5 |
| C-19 | plain | 34 × 45 | 36.5 | 91.3 |
| C-20 | plain | 34 × 50 | 43.0 | 107.5 |

**Table 2**. Woven designs, sizes, and weights of the paper oshiboris.

| No. | woven design | size | weight (g) | |
|---|---|---|---|---|
| | | (cm × cm) | dry | wet |
| P-1 | plain (mesh) | 27 × 28 | 6.0 | 18.2 |
| P-2 | roll (mesh) | 27 × 29 | 6.7 | 16.8 |
| P-3 | plain (mesh) | 20 × 25 | 2.7 | 6.7 |
| P-4 | roll (mesh) | 21 × 30 | 3.7 | 10.3 |
| P-5 | plain | 19 × 26 | 2.0 | 4.7 |
| P-6 | roll | 19 × 27 | 2.0 | 6.2 |
| P-7 | plain (thin) | 19 × 27 | 2.0 | 5.8 |
| P-8 | roll (thin) | 19 × 28 | 2.2 | 6.3 |
| P-9 | plain (standard) | 19 × 27 | 3.0 | 9.5 |
| P-10 | roll (standard) | 19 × 27 | 4.8 | 11.8 |
| P-11 | plain emboss (thick) | 20 × 27 | 3.0 | 6.3 |
| P-12 | roll emboss (thick) | 18 × 30 | 3.3 | 7.2 |
| P-13 | plain emboss (thin) | 19 × 26 | 2.5 | 6.5 |
| P-14 | roll emboss (thin) | 19 × 27 | 2.5 | 6.0 |
| P-15 | plain (mesh) | 18 × 27 | 1.8 | 4.2 |
| P-16 | roll (mesh) | 18 × 27 | 1.7 | 4.5 |
| P-17 | plain (standard) | 18 × 26 | 2.0 | 5.7 |
| P-18 | roll emboss (thick) | 18 × 26 | 2.0 | 5.7 |
| P-19 | plain (thick) | 27 × 27 | 4.0 | 13.0 |
| P-20 | roll imbrication | 29 × 30 | 4.8 | 11.7 |

### 2.2. Procedure

We prepared a set of cotton oshiboris (C-1 to C-20 in Table 1) and a set of paper oshiboris (P-1 to P-20 in Table 2) per one subject. We passed the oshiboris to the subjects in random order one by one, and asked the subjects to evaluate the oshiboris by grading them from one to five (one being the lowest and five being the highest) based on the following properties, "comfortableness," "luxuriousness," "relaxation," "refreshingness," "volume," "moisture," "absorption," "hand-feel," and "satisfaction." After using each oshibori, the subjects filled the evaluation sheet shown in Fig. 1,

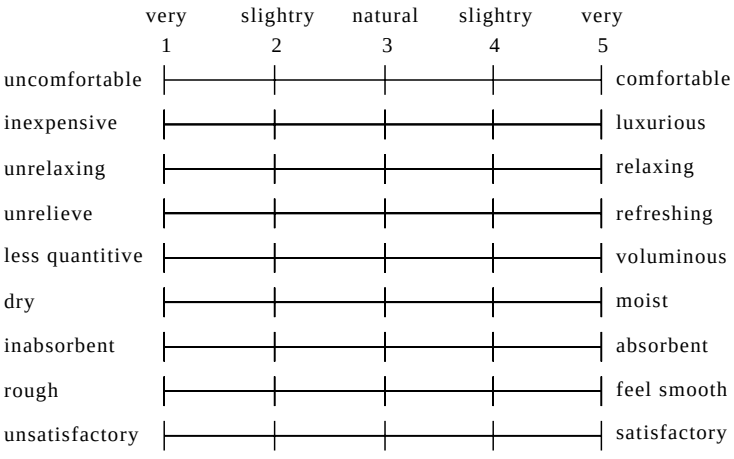


**Fig. 1**. Evaluation sheet of the experiment.

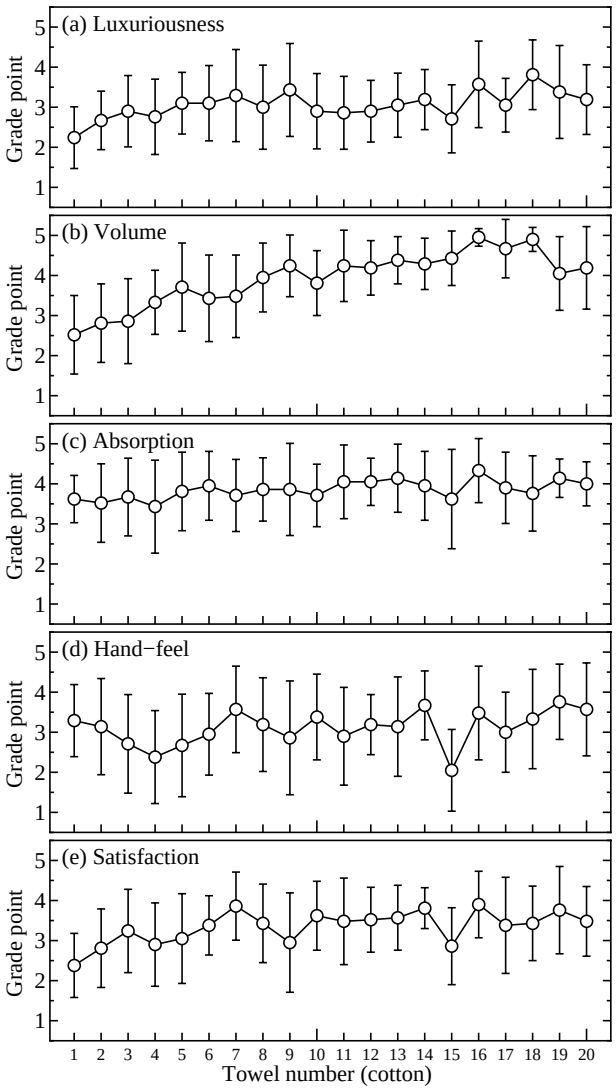


**Fig. 2**. Evaluation results of the cotton oshiboris on "luxuriousness," "volume," "absorption," "hand-feel," and "satisfaction." The open circles denote the averages of the evaluation values, and the error bars denote the standard deviations.

and dried their hands with a blower to avoid influences on the feeling of next oshibori.

### 2.3. Subjects

Nineteen males and two females, aged 21 to 24 years old, participated in the experiment as subjects.

## 3. RESULTS

### 3.1. Cotton oshibori

Figure 2 shows the evaluation results of the cotton oshiboris C-1 to C-20 in Table 1. (a) to (e) correspond to the results about the evaluation terms of "luxuriousness," "volume," "absorption," "hand-feel," and "satisfaction," respectively. The vertical and horizontal and vertical axes denote

the grade point and the towel number. The open circles denote the averages of the evaluation values, and the error bars denote the standard deviations.

The evaluation value on "luxuriousness" tends to become large as the towel number increases (the towel number increase is almost equivalent to the weight increase). The evaluation value on "volume" becomes large as the weight of the oshibori increases. The values on "absorption" are generally high. Considering the reason that we adjusted the amount of moisture almost constant for all cotton oshiboris. The values on "hand-feel" almost shows the mean value except the value of C-15 is low. About the values on "satisfaction," the overall tendency is almost the same as the values on "luxuriousness."

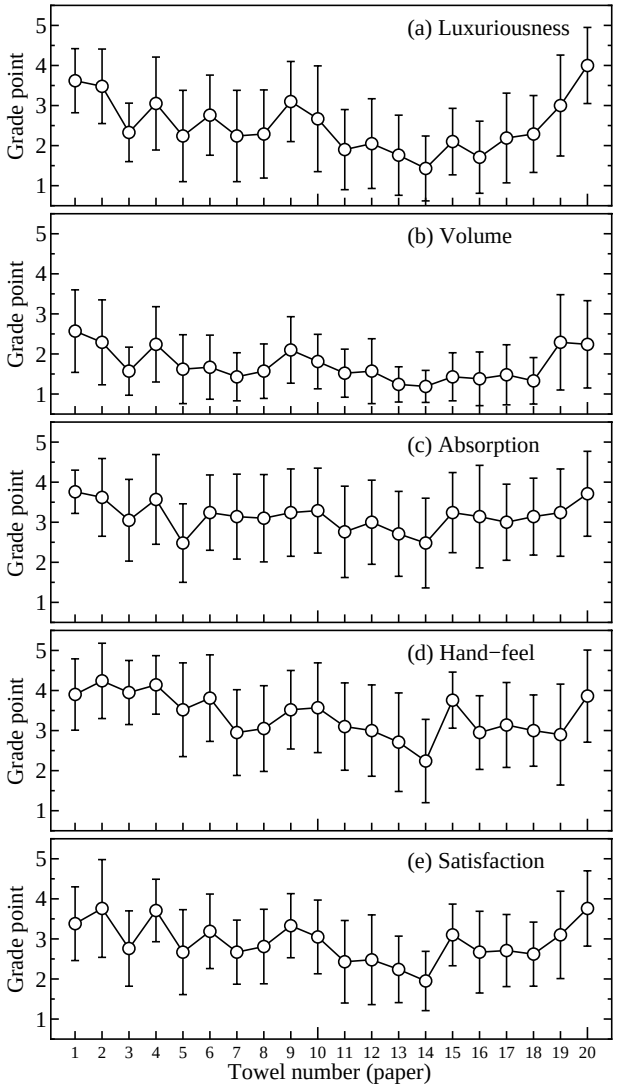


**Fig. 3**. Evaluation results of the paper oshiboris on "luxuriousness," "volume," "absorption," "hand-feel," and "satisfaction." The open circles denote the averages of the evaluation values, and the error bars denote the standard deviations.

### 3.2. Paper oshibori

Figure 3 shows the evaluation results of the paper oshiboris P-1 to P-20 in Table 2. (a) to (e) correspond to the results about the evaluation terms of "luxuriousness," "volume," "absorption," "hand-feel," and "satisfaction," respectively.

About on "luxuriousness," the dispersion of the evaluation value is large depending on the kind of the paper oshiboris. The evaluation values on "volume" are generally low. This reason is that the weights of the paper oshiboris are generally lower than those of the cotton oshiboris. The overall values on "absorption" are generally lower than those of the cotton oshiboris (Fig. 2(c)). The value on "hand-feel" varies greatly depending on the kind of the paper oshiboris. The value on "satisfaction" also varies greatly, but the overall tendency is almost the same as the values on "luxuriousness." This result is similar to the case of the cotton oshiboris.

## 4. DISCUSSIONS

### 4.1. Correlation relationship

To further analyze the experimental results, we discuss relationships among the evaluation terms of "comfortableness," "luxuriousness," "relaxation," "refreshingness," "volume," "moisture," "absorption," "hand-feel," and "satisfaction." In this section, we calculated the correlation coefficients among all evaluation terms.

#### *4.1.1. Cotton oshiboris*

Table 3 shows the correlation coefficients among all evaluation terms in cases of the cotton oshiboris. In Table 3, "comfortableness" strongly correlates with "relaxation, " "refreshingness," "hand-feel," and "satisfaction." "Relaxation" strongly correlates with "refreshingness," "hand-feel," and "satisfaction." "Refreshingness" strongly correlates with "hand-feel" and "satisfaction." "Moisture" strongly correlates with "hand-feel."

**Table 3**. Correlation coefficients among all evaluation terms of the cotton oshiboris.

| | comfortable-ness | luxurious-ness | relaxation | refreshing-ness |
|---|---|---|---|---|
| comfortableness | 1.00 | - | - | - |
| luxuriousness | 0.39 | 1.00 | - | - |
| relaxation | 0.90 | 0.50 | 1.00 | - |
| refreshingness | 0.91 | 0.44 | 0.90 | 1.00 |
| volume | 0.30 | 0.67 | 0.26 | 0.34 |
| absorption | 0.66 | 0.51 | 0.67 | 0.67 |
| moisture | 0.53 | 0.61 | 0.66 | 0.66 |
| hand-feel | 0.89 | 0.40 | 0.88 | 0.87 |
| satisfaction | 0.73 | 0.65 | 0.78 | 0.81 |

| | volume | absorption | moisture | hand-feel | satisfaction |
|---|---|---|---|---|---|
| volume | 1.00 | - | - | - | - |
| absorption | 0.63 | 1.00 | - | - | - |
| moisture | 0.38 | 0.56 | 1.00 | - | - |
| hand-feel | 0.14 | 0.48 | 0.71 | 1.00 | - |
| satisfaction | 0.55 | 0.68 | 0.55 | 0.61 | 1.00 |

**Table 4**. Correlation coefficients among all evaluation terms of the paper oshiboris.

| | comfortable-ness | luxurious-ness | relaxation | refreshing-ness |
|---|---|---|---|---|
| comfortableness | 1.00 | - | - | - |
| luxuriousness | 0.86 | 1.00 | - | - |
| relaxation | 0.96 | 0.85 | 1.00 | - |
| refreshingness | 0.87 | 0.72 | 0.86 | 1.00 |
| volume | 0.73 | 0.92 | 0.75 | 0.63 |
| absorption | 0.82 | 0.85 | 0.82 | 0.69 |
| moisture | 0.36 | 0.29 | 0.37 | 0.50 |
| hand-feel | 0.88 | 0.72 | 0.88 | 0.70 |
| satisfaction | 0.94 | 0.91 | 0.94 | 0.85 |

| | volume | absorption | moisture | hand-feel | satisfaction |
|---|---|---|---|---|---|
| volume | 1.00 | - | - | - | - |
| absorption | 0.78 | 1.00 | - | - | - |
| moisture | 0.23 | 0.52 | 1.00 | - | - |
| hand-feel | 0.65 | 0.69 | 0.12 | 1.00 | - |
| satisfaction | 0.85 | 0.89 | 0.48 | 0.85 | 1.00 |

On the other hand, "comfortableness" weakly correlates with "luxuriousness," and "volume" weakly correlates with "comfortableness, " "relaxation," "refreshingness," "moisture," and "hand-feel." The reason why the correlations of the items concerning "volume" are weak is that the evaluation values of "volume" were generally high since the weight of each cotton oshibori was high enough to feel "volume" compared with the paper oshiboris.

#### *4.1.2. Paper oshiboris*

Table 4 show the correlation coefficients among all evaluation terms in cases of the paper oshiboris. In Table 4, the correlation coefficients among each evaluation term are generally high compared with those of the cotton oshiboris (Table 3). "Comfortableness," "luxuriousness," "relaxation," and "satisfaction" strongly correlate with all evaluation terms except "moisture." Additionally, there are strong correlations between "refreshingness" and "hand-feel." and between "volume" and "absorption."

On the other hand, "moisture" weakly correlates with "comfortableness," "luxuriousness," "relaxation," "volume," and "hand-feel." This result shows that a paper oshibori containing moisture almost twice to three times more weight than that when it dries is enough to feel "moisture."

### 4.2. Comparison between cotton and paper oshiboris

Finally, we compared the evaluation results between the cotton and paper oshiboris. Figure 4 shows the average values on the all evaluation terms of "comfortableness," "luxuriousness," "relaxation," "refreshingness," "volume," "moisture," "absorption," "hand-feel," and "satisfaction." The open and filled circles denote the evaluation values of the cotton and paper oshiboris, respectively. The error bars denote the standard deviations.

In Fig. 4, the evaluation values of the cotton oshiboris were generally higher than those of the paper oshiboris on all evaluation terms except "moisture" and "hand-feel." The

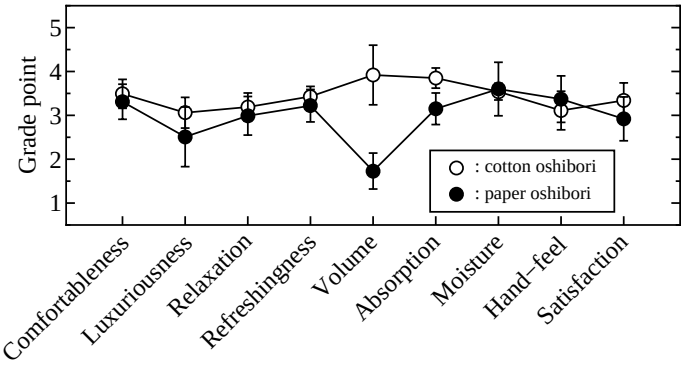


**Fig. 4**. Average values on the all evaluation terms. The open and filled circles denote the evaluation values of the cotton and paper oshiboris, respectively. The error bars denote the standard deviations.

**Table 5**. Results of t-tests between the average values of the cotton and paper oshiboris in each evaluation terms. '*' and '**' denote that differences of the average values are significant at levels of 5% and 1%, respectively.

| Evaluation term | t-value | critical t-value | |
|---|---|---|---|
| | | 5% | 1% |
| comfortableness | 1.61 | 1.69 | 2.43 |
| luxuriousness | 3.18** | 1.69 | 2.43 |
| relaxation | 1.67 | 1.69 | 2.43 |
| refreshingness | 2.10* | 1.69 | 2.43 |
| volume | 12.4** | 1.69 | 2.43 |
| absorption | 7.46** | 1.69 | 2.43 |
| moisture | −0.44 | 1.69 | 2.43 |
| hand-feel | −1.64 | 1.69 | 2.43 |
| satisfaction | 2.93** | 1.69 | 2.43 |

evaluation values of the cotton oshiboris on "luxuriousness," "volume," "absorption," and "satisfaction" are considerably higher than those of the paper oshiboris.

To verify these differences statistically, we performed t-tests between the average values of the cotton and paper oshiboris in each evaluation term. From the results of t-tests in Table 5, the evaluation values of the cotton oshiboris on the terms of "luxuriousness," "volume," "absorption," and "satisfaction" are higher than those of the paper oshiboris at a significant level of 1%, and the value of the cotton oshiboris on "refreshingness" is higher than that of the paper oshiboris at a significant level of 5%.

## 5. CONCLUSIONS

To quantitatively evaluate the feel of the oshibori, we carried out a subjective evaluation experiment using oshiboris which were made of cotton and paper. In the experiment, we evaluated the cotton and paper oshiboris based on the following properties "comfortableness," "luxuriousness," "relaxation," "refreshingness," "volume," "moisture," "absorp-

tion," "hand-feel," and "satisfaction." As a result, the evaluation values of the cotton oshiboris were generally higher than those of the paper oshiboris on all evaluation terms except "moisture" and "hand-feel," in particular, the evaluation values of the cotton oshiboris on the terms of "luxuriousness," "refreshingness," "volume," "absorption," and "satisfaction" are significantly higher than those of the paper oshiboris.

## 6. REFERENCES


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