

ORIGINAL ARTICLE

Study on Factors of Favorable Wet Cotton Hand Towels “*Oshibori*”

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Abstract: In the present study, we evaluated important factors of the feelings of comfort associated with wet cotton hand towels, or *oshibori*. First, the following adjectives were extracted as words used to evaluate the characteristics of the *oshibori*: “large,” “pretty,” “comfortable,” “high-grade,” “shapely,” “soft,” “favorite,” “thick,” “clean,” “moist,” “luxurious,” “heavy,” “strong,” “safe,” “good-touch,” and “rare.” We then conducted a subjective evaluation of 25 kinds of *oshibori* of various sizes and thicknesses. Forty males and twenty-four females, ranging in age from their twenties to fifties, participated in the experiment. Each subject evaluated the *oshibori* by grading them from one to five based on the extracted descriptive characteristics. Factor analysis was conducted on the experimental results and the following three factors were extracted; the first factor defined as “dignity factor,” the second factor defined as “preference factor,” and the third factor defined as “touch factor.” The score for dignity increased as the size of the *oshibori* increased. The score for preference was high when the size of the *oshibori* was between 25 cm × 25 cm and 30 cm × 30 cm. These results suggest that subjects felt high-class if the size of the *oshibori* was greater than 30 cm × 30 cm, but subjects most preferred *oshibori* that were between 25 cm × 25 cm and 30 cm × 30 cm. No notable trend was found between the thickness of *oshibori* and the three factors. We then analyzed the experimental data focusing on the following viewpoints; “gender” and “generation.” of the subjects, and discussed how these factors effected on the feelings of *oshibori* using the Mann-Whitney *U* test and the Kruskal-Wallis *H* test. The analyzed results show that the female subjects tended to evaluate more highly on the evaluation words of “thick,” “moist,” and “heavy,” that the evaluations of “large,” “pretty,” “comfortable,” “high-grade,” “shapely,” “soft,” “favorite,” “thick,” “moist,” “luxurious,” “heavy,” “strong,” “safe,” “good-touch,” and “rare” varied depending on generation.

Keywords: *oshibori*, hand towel, subjective evaluation

1. INTRODUCTION

When you come into cafes and restaurants in Japan, you will be given a glass of water and *oshibori*. *Oshibori* is a kind of small wet towels to wipe face and hands. Serving *oshibori* to guests is one of the long-standing traditions in Japan, and it is rarely seen outside of Japan. While lots of researches have been conducted on *oshibori* over the years, most of them have investigated the towels from the perspective of cleaning and sanitation [1-3]. Few studies have assessed the qualitative and sensory characteristics associated with *oshibori*. Thus, in order to assess *oshibori* qualitatively, we first conducted a subjective evaluation using cotton and paper ones [4], because most of *oshibori* are made of woven cotton or nonwoven paper. We reported that cotton *oshibori* were assessed more favorably than paper *oshibori* in many aspects. As an extension of the work, the present subjective evaluation was conducted to identify the important factors in determining the feeling of comfort associated with woven cotton *oshibori*, including the various sizes and thicknesses of *oshibori* that people prefer. *Oshibori* are generally used in hot or cold conditions. In this study, we, however, make no mention of thermal sensation when *oshibori* are used, because if we make experiments for the thermal sensation, we have to

control not only temperatures, sizes, and thicknesses of *oshibori* but also the room condition at various temperatures and humidity, it is too many parameters to perform the experiments. In this study, therefore, we focused on parameters of sizes and thicknesses of *oshibori*. We then analyzed the experimental data focusing on the following viewpoints; “gender” and “generation.” of the subjects and discussed how these factors effected on the feelings of *oshibori*.

2. EXTRACTION OF EVALUATION WORDS

In this section, we describe a method for extracting words to evaluate the characteristics of *oshibori*. First, a total of 1,189 possible adjectives that could describe *oshibori* were gathered from past studies on *oshibori* [1-3] and an adjective dictionary [5]. Next, ten people evaluated to determine whether or not each adjective was appropriate for evaluating *oshibori* using the following three grades (1: applicable, 2: neutral, and 3: not applicable). Based on the results, we discarded the words whose average scores exceeded 2.5 points. The 1,189 words were narrowed down to 221 words that were deemed applicable. These 221 words were then classified into 60 groups with similar meaning, and the word with the highest score in each group was identified as a representative adjective. Subsequently, 107 people evaluated to determine whether or not the 60

words were appropriate for evaluating *oshibori* using the three grade levels to narrow the list to 27 words. Of these 27 words, ones that were not appropriate for the purpose of the present study, such as words related to smell and convenience, were excluded, and the following 16 words were chosen to evaluate *oshibori*: large, pretty, comfortable, high-grade, shapely, soft, favorite, thick, clean, moist, luxurious, heavy, strong, safe, good-touch, and rare. Along with each of these 16 words, an antonym was chosen to generate a list of 16 pairs of words to evaluate *oshibori*. The 16 pairs of words are listed in Table 1.

3. SUBJECTIVE EVALUATION OF OSHIBORI

We conducted a subjective evaluation experiment using the semantic differential (SD) method with the 16 words extracted in the previous section.

3.1 Samples

We used a total of 25 different kinds of cotton *oshibori* with five different sizes and five different thicknesses. All samples were pile-woven [7] and unused. In order to remove dirt and starch that became attached during manufacturing, all samples were washed once; the level of residual chlorine was set at less than 100 ppm. The regain of each *oshibori* was 2.5 times its relative dry weight [8], and in order to avoid changes in the regain, each sample was wrapped in a film. The size, color, woven design, yarn count, weaving density, thickness and weight of each sample type are shown in Table 2. The temperature and humidity of the laboratory was set at $20 \pm 2^\circ\text{C}$ and $60 \pm 3\%$ RH, respectively.

3.2 Procedure

Each sample was packed in a vinyl bag and all samples were prepared for each subject. The subjects were instructed to randomly choose one *oshibori* at a time from

Table 1: Words used to evaluate *oshibori*

small (小さい)	↔	large (大きい)
ugly (可愛くない)	↔	pretty (可愛い)
uncomfortable (気持ち悪い)	↔	comfortable (気持ち良い)
cheap (安っぽい)	↔	high-grade (高級感のある)
unshapely (かっこ悪い)	↔	shapely (かっこ良い)
hard (固い)	↔	soft (柔らかい)
unfavorable (嫌いな)	↔	favorite (好きな)
thin (薄い)	↔	thick (厚い)
dirty (汚い)	↔	clean (きれいな)
dry (乾いた)	↔	moist (湿った)
simple (簡単な)	↔	luxurious (豪華な)
light (軽い)	↔	heavy (重い)
weak (貧弱な)	↔	strong (丈夫な)
unsafe (安心でない)	↔	safe (安心な)
bad-touch (肌触りの悪い)	↔	good-touch (肌触りの良い)
common (ありふれた)	↔	rare (珍しい)

the 25 available and wipe their hands to evaluate it. With regards to how to use the *oshibori*, although we ordered them to wipe their hands only, we imposed no restriction except it. Subjects then scored the selected *oshibori* on a grade from 1 to 5 (1: lowest; 5: highest) in the 16 categories. The evaluation sheet used in the experiment is shown in Figure 1. Figure 1 shows the evaluation sheet. After each evaluation, the subjects were instructed to sufficiently dry their hands using a towel or an electric fan to

Table 2: Sizes, color, woven design, yarn count, weaving density, thicknesses, and weights of cotton *oshibori* evaluated in the present study.

No.	size (cmxcm)	color	woven design	yarn count	weaving density (number/2.54cm)		thickness (mm)	weight(g)		unit weight (g/mf)
					warp	weft		dry	wet	
C-1	20x20	white	pile	20/1	17	21	1.52	13.0	32.5	812.5
C-2	20x20	white	pile	20/1	16	22	1.84	13.6	34.0	849.4
C-3	20x20	white	pile	20/1	19	19	1.99	15.0	37.5	937.5
C-4	20x20	white	pile	20/1	18	22	2.29	16.0	40.0	1000.0
C-5	20x20	white	pile	20/1	18	24	2.44	16.7	41.7	1041.7
C-6	25x25	white	pile	20/1	17	21	1.63	20.8	52.1	833.3
C-7	25x25	white	pile	20/1	17	21	1.89	22.3	55.6	890.0
C-8	25x25	white	pile	20/1	18	22	2.02	24.5	61.3	980.0
C-9	25x25	white	pile	20/1	19	22	2.35	25.7	64.2	1026.7
C-10	25x25	white	pile	20/1	18	20	2.55	27.8	69.6	1113.3
C-11	30x30	white	pile	20/1	17	21	1.69	28.8	72.1	800.9
C-12	30x30	white	pile	20/1	17	20	1.89	30.7	76.8	852.8
C-13	30x30	white	pile	20/1	19	19	2.10	33.7	84.2	935.2
C-14	30x30	white	pile	20/1	18	22	2.34	36.0	90.0	1000.0
C-15	30x30	white	pile	20/1	16	18	2.65	39.0	97.5	1083.3
C-16	35x35	white	pile	20/1	20	23	1.75	41.3	103.3	843.5
C-17	35x35	white	pile	20/1	20	22	1.96	44.3	110.8	904.1
C-18	35x35	white	pile	20/1	16	17	2.16	47.8	119.6	976.2
C-19	35x35	white	pile	20/1	19	22	2.40	51.0	127.5	1040.8
C-20	35x35	white	pile	20/1	17	20	2.62	54.2	135.4	1105.4
C-21	40x40	white	pile	20/1	18	21	1.79	52.8	132.1	825.5
C-22	40x40	white	pile	20/1	17	20	2.12	60.4	150.9	943.0
C-23	40x40	white	pile	20/1	16	17	2.50	68.5	171.3	1070.3
C-24	40x40	white	pile	20/1	18	19	2.58	70.7	176.7	1104.2
C-25	40x40	white	pile	20/1	16	17	2.80	76.0	190.0	1187.5



Figure 1: Evaluation sheet of the experiment

avoid influencing the evaluation of the next sample. The evaluation process was divided into two sessions to avoid fatigue of the subjects, with a break of at least one hour between them. Twelve samples were evaluated during the first part and 13 samples in the second part. One session of the experiment took less than 30 minutes.

3.3 Subjects

Sixty-four people (males: 40; females: 24; age range: 20–59 years) participated in the experiment. The subjects were university students, faculties, or clerks who had no expert knowledge of cotton *oshibori*. All subjects participated in subjective evaluation tests for cotton *oshibori* for the first time.

4. RESULTS AND DISCUSSION

4.1 Evaluation scores

The results for the following words that exhibited characteristic trends for the 25 different *oshibori* (Table 2: C1 to C25) are shown in Figure 2: “favorite,” “comfortable,” “shapely,” “thick,” “strong,” “rare,” “pretty,” “high-grade,” “luxurious,” “soft,” “clean,” and “good-touch.” We assembled every 3 evaluation words because the tendencies of the evaluation results were similar or opposite. In Figure 2(a), ○, ●, and □ indicate “favorite,” “comfortable,”

and “shapely,” respectively. In Figure 2(b), ○, ●, and □ indicate “thick,” “strong,” and “rare,” respectively. In Figure 2(c), ○, ●, and □ indicate “pretty,” “high-grade,” and “luxurious,” respectively. In Figure 2(d), ○, ●, and □ indicate “soft,” “clean,” and “good-touch,” respectively. The error bars represent the standard deviations.

Data suggest that, in terms of “favorite,” “comfortable,” and “shapely,” 25 cm × 25 cm and 30 cm × 30 cm *oshibori* were evaluated highly. The general size range for *oshibori* is 28 cm × 28 cm to 30 cm × 30 cm, suggesting that familiar sizes were evaluated favorably. It could be considered that the subjects pictured scenes from general restaurants in their mind. In terms of “thick” and “strong” the tendency was that the thicker the *oshibori*, the higher the evaluations “thick” and “strong.” With regards to “rare,” the subjects tended to view 20 cm × 20 cm and 40 cm × 40 cm *oshibori* as rare. As to “pretty,” the smaller the size of the *oshibori*, the greater the score. In terms of “high-grade” and “luxurious” the scores for sizes larger than 30 cm × 30 cm were comparable, and as a result, large, 35 cm × 35 cm or 40 cm × 40 cm, *oshibori* are not necessarily viewed as high-grade or luxurious. This result denotes that the subjects judged “high-grade” and “luxurious” of *oshibori* based on commonly-used sizes (28 cm × 28 cm to 30 cm × 30 cm) and they felt the *oshibori* larger than 30 cm × 30 cm more high-grade and luxurious. For this reason, we believe that serving *oshibori* larger than 30 cm × 30 cm to guests is one of the effective methods to create high-grade and luxurious atmosphere in restaurants. The scores for “soft,” “clean,” and “good-touch” were mostly comparable because all samples were unused, made of identical material.

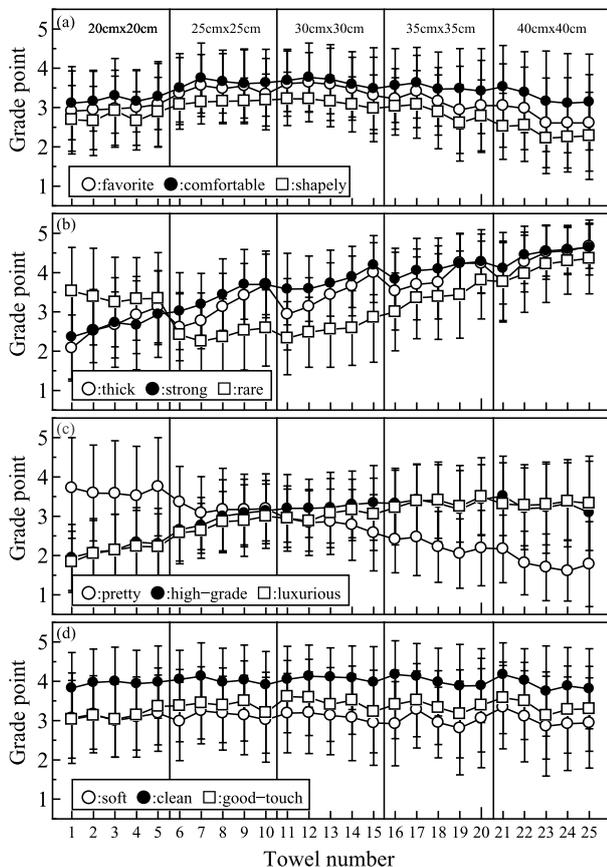


Figure 2: *Oshibori* evaluation results

4.2 Gender differences

Figure 3 shows the evaluation results separated according to gender. The symbols ○ and ● indicate average

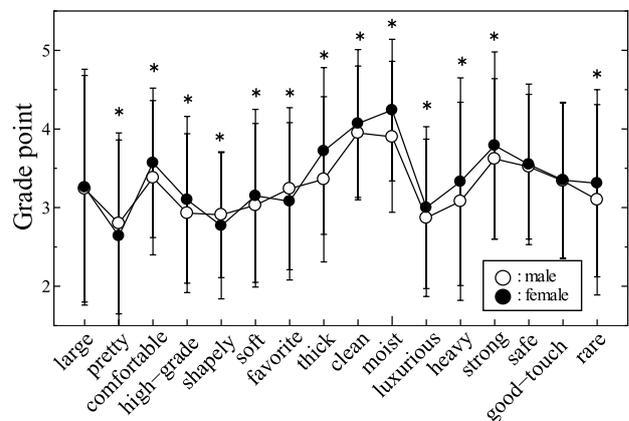


Figure 3: Evaluation results on gender. The symbols ○ and ● represent the results of the male and female subjects, respectively. The error bars denote the standard deviations. “*” represent significant differences at a level of 5%. The number of subjects; males: 40, females: 24.

values of male and female subjects, respectively. The error bars represent the standard deviations. Figure 3 suggests that, in terms of “comfortable,” “high-grade,” “soft,” “thick,” “clean,” “moist,” “luxurious,” “heavy,” “strong,” and “rare,” the evaluated values of the females are relatively higher than those of the males.

We performed the Mann-Whitney *U* test [9] between the average values of the male subjects and those of the female subjects in each evaluation term using SPSS16.0J (SPSS Japan Inc.). As results, there were significant differences in terms of “pretty,” “comfortable,” “high-grade,” “shapely,” “soft,” “favorite,” “thick,” “clean,” “moist,” “luxurious,” “heavy,” “strong,” and “rare” at a level of 5%. These results show that the females tended to evaluate more highly the evaluation words of “comfortable,” “high-grade,” “soft,” “thick,” “clean,” “moist,” “luxurious,” “heavy,” “strong,” and “rare” than those of the males. One of the reasons for these results could be considered that the material and woven design of the samples gave more comfort to the females than the males.

We also focused on the terms of “thick,” “moist,” and “heavy” of which differences of the average scores between the males and the females were relatively high (≥ 0.25). Figure 4 (a), (b), and (c) shows the evaluation results separated according to gender on 25 different *oshibori* in terms of “thick,” “moist,” and “heavy,” respectively. The symbols \circ and \bullet indicate average values of the male and the female subjects, respectively. The error bars

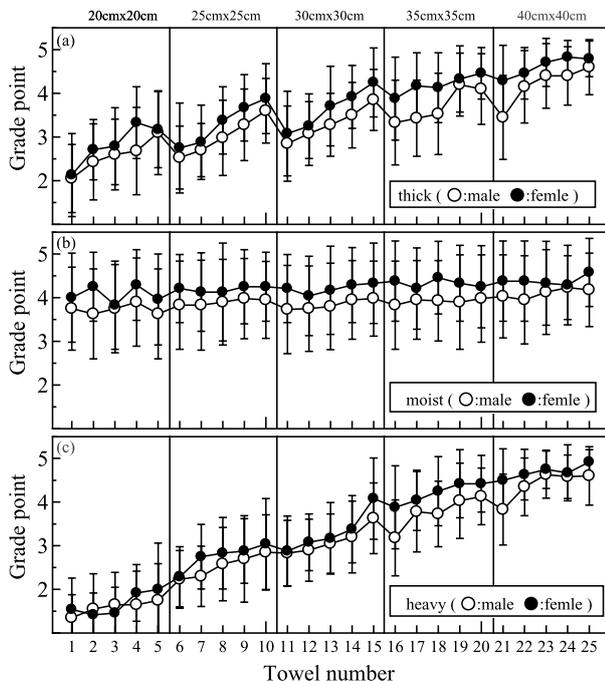


Figure 4: Evaluation results on “thick,” “moist,” and “heavy.” The symbols \circ and \bullet represent the results of the male and female subjects, respectively. The error bars denote the standard deviations.

represent the standard deviations.

As shown in Figures 4, the female subjects tended to evaluate more highly on the evaluation words of “thick,” “moist,” and “heavy.” One of the reasons is considered that the threshold of pressure sensation is different between males and females. Weinstein reported that the male’s threshold of pressure sensation was significantly higher than the female’s threshold, i.e., females were more sensitive for pressure sensitivity than males [10]. Also Ushioda and Nakajima reported that the higher pressure on the skin by fiber fabrics, the more increase in soaking sensation [11]. It is, therefore, considered that the female subjects felt the changes in thickness, weight, and moistness of *oshibori* more sensitive than the male subjects in our experiment.

4.3 Generation differences

Figure 5 shows the evaluation results separated according to generation. The symbols \circ , \bullet , \square , and \blacksquare indicate the average values of the subjects in their 20’s, 30’s, 40’s, and 50’s, respectively. The error bars represent the standard deviations. Figure 5 suggests that, in terms of “pretty,” “comfortable,” “high-grade,” “soft,” “thick,” “luxurious,” “heavy,” “strong,” “safe,” “good-touch,” and “rare,” there were slight differences in all generation groups. The evaluated values on the 50’s were relatively higher than those of the other groups, and the evaluated values on 40’s were relatively lower than those of the other groups. However, the score of “clean” was mostly comparable in all generation groups.

We first performed the Kruskal-Wallis *H* test [9] for the average values among all generation groups of 20’s, 30’s, 40’s, and 50’s in each evaluation term. As results, there were significant differences in terms of “large,” “pretty,”

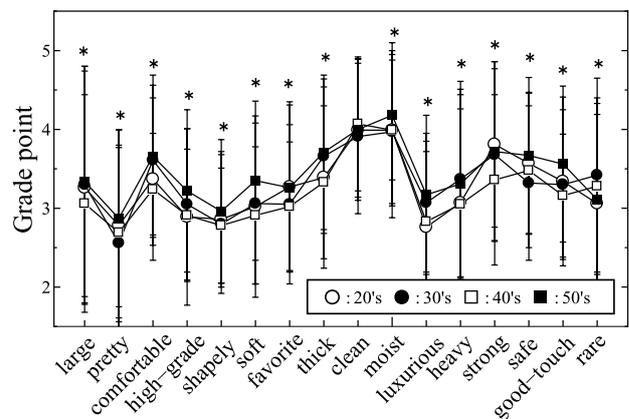


Figure 5: Evaluation results on generation. The symbols \circ , \bullet , \square , and \blacksquare represent the results of 20’s, 30’s, 40’s, and 50’s, respectively. The error bars denote the standard deviations. “*” represent significant differences at a level of 5%. The number of subjects; 20’s: 27, 30’s: 12, 40’s: 12, 50’s: 13.

“comfortable,” “high-grade,” “shapely,” “soft,” “favorite,” “thick,” “moist,” “luxurious,” “heavy,” “strong,” “safe,” “good-touch,” and “rare” at a level of 5%. It could be that the preference for *oshibori* varies depending on generation.

We next performed the Mann-Whitney *U* test to clarify the significant differences among the average values in each generation. As results, there were significant differences between the scores of 40’s and 50’s in terms of “large,” “pretty,” “comfortable,” “high-grade,” “shapely,” “soft,” “favorite,” “thick,” “luxurious,” “heavy,” “strong,” “safe,” “good-touch,” and “rare” at a level of 5%.

We here focused on the evaluation results of “high-grade” and “luxurious” because the tendencies of the evaluation results were distinctive. Figure 6 (a), (b) shows the evaluation results on 25 different *oshibori* separated according to generation in terms of “high-grade” and “luxurious,” respectively. The symbols ○, ●, □, and ■ indicate the average values of the scores of 20’s, 30’s, 40’s, and 50’s subjects, respectively. The error bars represent the standard deviations. As shown in Figure 6, the 50’s subjects tended to evaluate higher than those of the other groups when the size of *oshibori* was 35 cm × 35 cm to 40 cm × 40 cm. However, there was no notable tendency for the difference of the evaluation scores among generations.

4.4 Evaluation word correlations

In this section, we discuss the correlation coefficient among each evaluation word, as shown in Table 3. Strong positive correlations with coefficients of more than 0.8 were seen among “favorite,” “comfortable,” and “shapely.” “Large” has a strong positive correlation to “high-grade,” “thick,” “luxurious,” “heavy,” and “strong.” “High-grade”

Table 3: Correlation coefficients among all words used to evaluate cotton *oshibori*

	favorite	comfortable	large	pretty	high-grade	shapely	soft	thick
favorite	1.000	-	-	-	-	-	-	-
comfortable	0.907	1.000	-	-	-	-	-	-
large	-0.241	0.100	1.000	-	-	-	-	-
pretty	0.404	0.075	-0.976	1.000	-	-	-	-
high-grade	0.199	0.486	0.867	-0.772	1.000	-	-	-
shapely	0.945	0.818	-0.397	0.552	0.034	1.000	-	-
soft	0.521	0.422	-0.282	0.377	-0.070	0.402	1.000	-
thick	-0.407	-0.113	0.877	-0.905	0.745	-0.510	-0.429	1.000
clean	0.719	0.724	-0.047	0.189	0.233	0.636	0.612	-0.311
moist	-0.410	-0.187	0.783	-0.822	0.658	-0.546	-0.393	0.836
luxurious	-0.016	0.304	0.944	-0.882	0.960	-0.157	-0.207	0.857
heavy	-0.303	0.025	0.982	-0.977	0.847	-0.450	-0.334	0.943
strong	-0.212	0.103	0.956	-0.942	0.881	-0.354	-0.325	0.952
safe	0.520	0.721	0.659	-0.520	0.891	0.378	0.091	0.481
good-touch	0.620	0.706	0.361	-0.217	0.600	0.427	0.585	0.126
rare	-0.923	-0.781	0.464	-0.589	0.045	-0.931	-0.347	0.572

	clean	moist	luxurious	heavy	strong	safe	feel-smooth	rare
clean	1.000	-	-	-	-	-	-	-
moist	-0.311	1.000	-	-	-	-	-	-
luxurious	0.062	0.758	1.000	-	-	-	-	-
heavy	-0.167	0.837	0.937	1.000	-	-	-	-
strong	-0.132	0.820	0.950	0.985	1.000	-	-	-
safe	0.413	0.419	0.804	0.620	0.681	1.000	-	-
good-touch	0.704	0.079	0.474	0.284	0.333	0.739	1.000	-
rare	-0.578	0.517	0.253	0.512	0.421	-0.281	-0.359	1.000

has a strong positive correlation to “luxurious,” “heavy,” “strong,” and “safe.” “Thick” has a strong positive correlation to “moist,” “luxurious,” “heavy,” and “strong.” “Moist” has a strong positive correlation to “heavy” and “strong.” Also, “luxurious” has a strong positive correlation to “heavy,” “strong,” and “safe.” Furthermore, “heavy” has a positive correlation to “strong.” Therefore, the subjects associated the size (“large”) and the thickness (“thick”) with high-gradeness (“high-grade”) and luxuriousness (“luxurious”).

On the other hand, “rare” has a strong negative correlation to “favorite” and “shapely.” This suggested that the subjects did not prefer rareness in *oshibori*. Also, “pretty” has a strong negative correlation to “large,” “thick,” “moist,” “luxurious,” “heavy,” and “strong.”

5. FACTOR ANALYSIS

Factor analysis was conducted on the experimental results using the software SPSS 16.0J. Factors were extracted using the principal factor method, and the varimax rotation was used for rotating the factor axis. We extracted three factors with the eigen value > 1, and then the cumulative contribution ratio was 60.1%. The factor matrix after the rotation is shown in Table 4.

Factor analysis of the 16 evaluation words identified three factors, and each of these factors was named based on the associated words as follows: 1) “dignity” with high absolute factor loadings for “heavy,” “large,” “thick,”

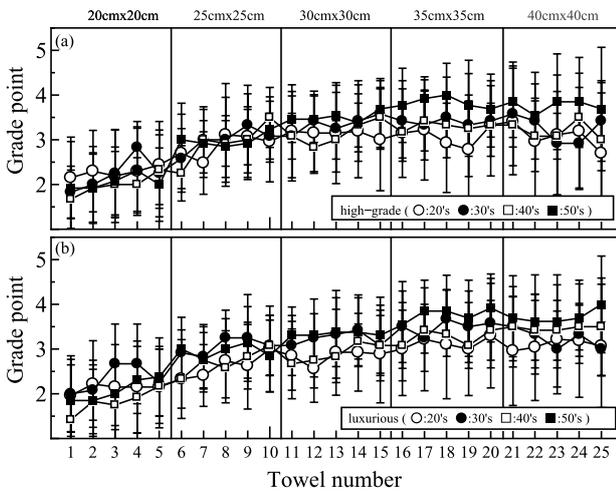


Figure 6: Evaluation results on “high-grade” and “luxurious.” The symbols ○, ●, □, and ■ represent the results of 20’s, 30’s, 40’s, and 50’s, respectively. The error bars denote the standard deviations.

Table 4: Factor matrix using the iterated principal factor method. Maximum number of iterations was 25 times and convergence criterion for the extraction was 0.001.

	factor		
	dignity	preference	touch
heavy	0.925	-0.031	-0.026
large	0.844	-0.006	0.030
thick	0.759	0.007	0.063
strong	0.743	0.157	0.190
luxurious	0.568	0.430	0.183
pretty	-0.526	0.336	0.174
rare	0.342	-0.219	0.053
shapely	-0.182	0.721	0.163
favorite	-0.112	0.709	0.399
high-grade	0.489	0.567	0.264
comfortable	0.014	0.534	0.506
safe	0.222	0.464	0.409
good-touch	0.062	0.326	0.764
soft	-0.067	0.129	0.598
moist	0.182	0.014	0.390
clean	0.007	0.252	0.385

“strong,” “luxurious,” “pretty,” and “rare” ; 2) “preference” with high absolute factor loadings for “shapely,” “favorite,” “high-grade,” “comfortable,” and “safe” ; and 3) “touch” with high absolute factor loadings for “good-touch,” “soft,” “moist,” and “clean.” Factor scores were calculated for the three extracted factors.

The relationship between dignity and preference factor scores is shown in Figure 7(a); between dignity and touch factor scores in Figure 7(b); and between preference and touch factor scores in Figure 7(c). In each figure, ○, ●, △, ▲, and □ represent 20, 25, 30, 35, and 40-cm square *oshibori*, respectively.

As shown in Figures 7(a) and (b), dignity factor scores mostly had positive values when the size of the *oshibori* was more than 30 cm × 30 cm, suggesting that people believe that *oshibori* larger than 30 cm × 30 cm are of high dignity. As shown in Figures 7(a) and (c), the preference factor scores were higher for 25 cm × 25 cm or 30 cm × 30 cm *oshibori*, suggesting that people prefer 25 cm × 25 cm to 30 cm × 30 cm *oshibori*. In Figures 7(b) and (c), no notable tendency is observed for touch factor scores in relation to *oshibori* size.

6. CONCLUSIONS

In the present study, numerous adjectives suited for evaluating the characteristics of *oshibori* were selected, and the following 16 words were extracted; “large,” “pretty,” “comfortable,” “high-grade,” “shapely,” “soft,” “favorite,” “thick,” “clean,” “moist,” “luxurious,” “heavy,” “strong,” “safe,” “good-touch,” and “rare.” *Oshibori* were

then subjectively evaluated using these 16 extracted words. Based on the results of the evaluation, correlation and factor analyses were performed, and then we analyzed the

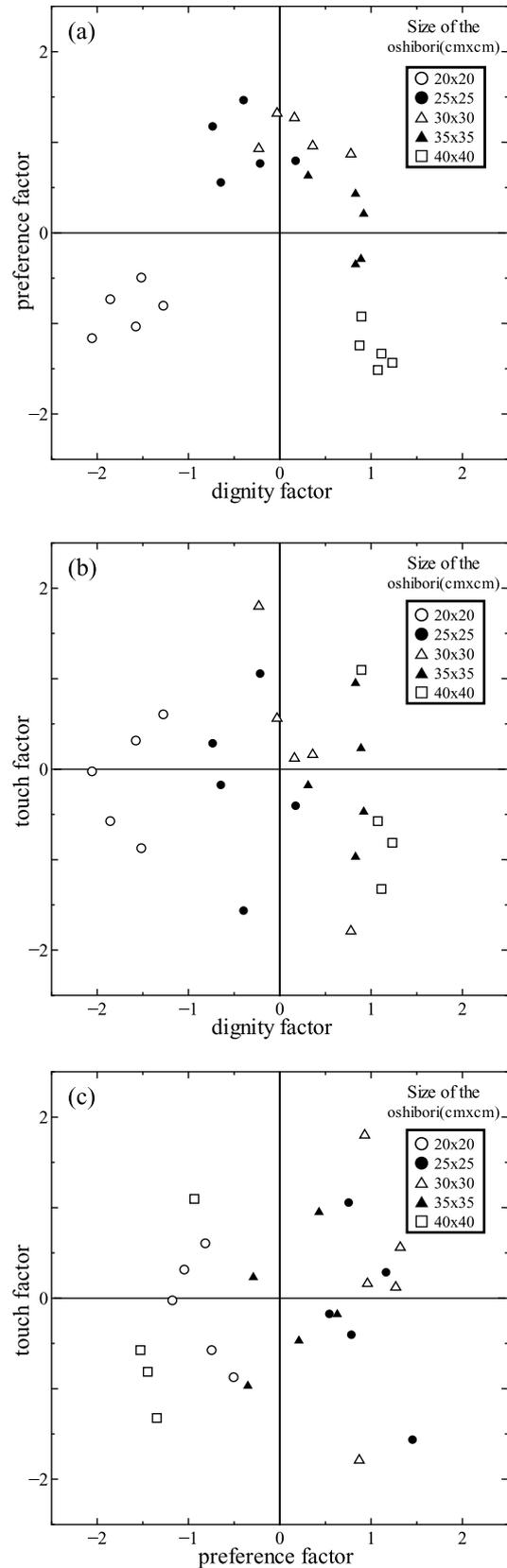


Figure 7: Relationships among “preference,” “dignity,” and “touch” factors.

experimental data focusing on the following viewpoints; “gender” and “generation” of the subjects. We furthermore discussed how these factors effected on the feelings of *oshibori* and the following results were obtained:

- The subjects viewed the size as an indicator for high-grade and luxurious *oshibori*.
- The subjects did not prefer rareness in *oshibori*.
- The important characteristics of *oshibori* were classified into preference, dignity, and touch factors.
- The scores of the dignity factor tended to be high for more than 30 cm × 30 cm *oshibori*.
- The scores of the preference factor tended to be high for 25 cm × 25 cm to 30 cm × 30 cm *oshibori*.
- The female subjects tended to evaluate more highly on the evaluation words of “thick,” “moist,” and “heavy.”

These results suggest that people perceive more than 30 cm × 30 cm *oshibori* as high-grade and luxurious *oshibori*, but prefer 25 cm × 25 cm to 30 cm × 30 cm *oshibori*, and suggest that the female subjects felt the changes in thickness, weight, and moistness of *oshibori* more sensitive than the male subjects.

REFERENCES

1. Y. Mizunoue and M. Aotani, “Studies on cleaning and sanitation of the “*oshibori*”, “Bulletin of the Faculty of Home Economics, Hiroshima Women’s University, Vol.7, pp.45-51, 1972.
2. U. Takeuchi, H. Seki, M. Ouko, M. Maki, M. Murase, K. Honda, T. Kanoh, and I. Mizoguchi, “Hygienic study on lease *OSHIBORI*,” Japanese Journal of Public Health, Vol.32, No.6, pp.275-286, 1985.
3. R. Juichi and T. Tabata, “Antimicrobial effect of “*oshibori*” containing essential oil,” Studies in Humanities and Science, Kobe Women’s Junior College, Vol.11, pp.61-66, 2000.
4. Y. Soeta, T. Kitamoto, H. Hasegawa, and M. Kasuga: Subjective evaluation of comfortableness of wet cotton and paper hand towels “*oshibori*”, Proc. of International Workshop on Advanced Image Technology 2008 (IWAIT2008), p.154, 2008.
5. Y. Tobita and H. Asada, “Dictionary of Present-day Adjective Usage,” Tokyodo, 1991.
6. Y. Soeta, R. Ando, T. Kitamoto, H. Hasegawa, and M. Kasuga, “Study on comfortable elements of wet cotton hand towels “*oshibori*”, International Conference on Kansei Engineering and Emotion Research 2010 (KEER2010).
7. T. Hongu, T. Kikutani, M. Takatera, H. Takahashi, N. Naruse, K. Hamada, K. Hara, N. Minemura, “Encyclopedia of Fiber,” Maruzen, 2002.
8. T. Miyakawa and K. Kawamura, “Bacteriological study on the safety use of home-prepared “*oshibori*”, “The journal of Wayo Women’s University, Vol.35, pp.1-6, 1995.
9. T. Onodera and K. Yamamoto, “SPSS-Output-Pedia: Base, “ Nakanishiya Shuppan, 2004.
10. Weinstein, S. Intensive and Extensive Aspects of Tactile Sensitivity as a Function of Body Part, Sex, and Laterality. In D.R. Kenshalo (Ed.), The Skin Senses (pp.195-222). Springfield, IL: Charles C. Thomas, 1968.
11. H. Ushioda, T. Nakajima, “Sensory Evaluation of Soaking Sense by Using Natural Fiber Fabrics,” Journal of the Japan Research Association for textile end-uses 36 (1), pp.44-52, 1995-01-25.



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