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Effect of Alcohol Disinfection on the Handle and Blade of Meat and Fish Knives by using ATP Inspection and Microbial Stamp Test

Akemi Ito [α], Naomi Katayama [σ], Mayumi Hirabayashi [ρ], Natuki Sasaki [ω] & Moe Inuzuka [¥]

Abstract- It is valid to show the cooks a visual hygiene test result to prevent food poisoning. Therefore, in this study, for hygiene control of the handle and blade of frequently used kitchen knives, we report inspections using the ATP wiping test and microbial stamp test. The results of the ATP wiping test showed that the ATP value decreased statistically significantly after washing compared to after cooking, and after70% alcohol spraying compared to after washing. A microbial stamp test (general bacteria, Escherichia coli, staphylococcous aureus, Salmonella, Vibrio parahaemolyticus) was also performed at the same time as the ATP test. As a result, the number of bacteria did not change much or decreased even after washing or spraying with 70% alcohol. In particular, Escherichia coli, staphylococcou aureus were found to be difficult to decrease even after 70%alcohol sprayings. In the future, it will be necessary to consider increasing the number of alcohol sprays of hygiene management using sodium hypochlorite.

Keywords: ATP test, microbial stamp test, the handle of the knife, the blade of the knife, alcohol disinfection.

I. Introduction

Hygiene management in the kitchen needs to do daily to prevent food poisoning. The number of food poisoning cases in Japan is high in ordinary households, and the number of victims is high in business establishments. If food poisoning occurs at a school lunch site, it will be a serious situation such as suspension of business, on-site inspection of the health center, transportation of patients to a hospital, and financial security for victims. In some cases, the lunch facility company will be closed, and the lunch service company will force to close. Currently, the kitchen is required to have a more severe sanitary environment due to the COVID-19 epidemic. Therefore, this study focuses on kitchen knives, which are cooking utensils that are highly likely to be involved in food poisoning in the kitchen, and reports the results of the tests using the ATP test and the microbial stamp test. The kitchen knives compared the inspection results on both the handle and the blade.

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II. Materials and Methods

a) Hygiene tests on Kitchen knife

Hygiene tests on six meat and fish knives performed using the ATP test kit (KIKKOMAN CO., Ltd.) and the microbial stamp test kit (NISSUI Co., Ltd.).

b) ATP wiping tests

ATP wiping tests performed on the handles and blades of 6 meat and fish knives. The ATP test was performed by the inspector three times immediately after cooking, after washing, and after spraying 70%alcohol. The inspector recorded the ATP test results.

c) Microbial stamp test

And the inspector performed a microbial stamp test as same as ATP tests (three times: after cooking, after washing, and after spraying alcohol). The microbial stamp was then cultured in an incubator at 38 degrees for three days. After culturing, microbial stamps were counted and recorded by the inspector.

d) Statistical processing

The results obtained compared using statistical methods. Compared data were subjected to an F test to determine whether to use a parametric test or nonparametric test. When there is no difference in the F test, the presence or absence of a significant difference was confirmed using the student t-test with or without a correspondence. If there was a difference in the F test, the presence or absence of a significant difference was confirmed using the Wilcoxon test with a pair or the Mann-Whitney test without correlation.

III. Results

a) Meat and fish knife: ATP results and microorganisms stamp test results of Alcohol disinfection

ATP test results of kitchen knife handle and blade

The ATP test results show in Table 1 (kitchen knife handle) and Table 2 (kitchen knife blade). In both cases, the ATP value is lower after washing than after cooking, but it did not fall below the target value of 100. However, after spraying with 70%alcohol, the ATP value was 100 or less. Alcohol spray can be said to be effective in hygiene management of kitchen knife handle and blade.

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Table1. ATP test value and statistical processing result of Kitchen knife Handle

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	113485	5426	5426	29
2	6915	873	873	41
3	813312	18399	18399	13
4	9631	1372	1372	9
5	10514	7055	7055	36
6	773	572	572	46
Average value	159105.0	5616.2	5616.2	29.0
SD	323332.8	6803.8	6803.8	15.1
F test	P=0.0001**		P=0.0001**	
Student-t*				
Wilcoxon	P=0.028*		P=0.028*	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.028*			

*Paired Student-t test * P<0.05, ** P<0.01

Table2. ATP test value and statistical processing result of Kitchen knife Blade

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	22404	247	247	8
2	96	661	661	12
3	393798	2701	2701	77
4	1125	63	63	63
5	23009	4260	4260	25
6	1638	894	894	30
Average value	73678.3	1471.0	1471.0	35.8
SD	157188.5	1659.0	1659.0	28.0
F test	P=0.0001**		P=0.0001**	
Student-t*				
Wilcoxon	P=0.046*		P=0.043*	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.028*			

*Paired Student-t test * P<0.05, ** P<0.01

b) Microorganisms stamp test results of kitchen knife handle and blade

The results of the microbial stamp test (general bacteria) show in Table 3 (kitchen knife handle) and Table 4 (kitchen knife blade).

Table 3 Number of general bacteria on Kitchen knife Handle and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	14	41	41	0
2	2	20	20	3
3	123	150	150	16
4	4	31	31	0
5	65	41	41	9
6	18	5	5	1
Average value	37.7	48.0	48.0	4.8
SD	47.7	51.8	51.8	6.4
F test	P=0.423		P=0.0001**	
Student-t*	P=0.319			
Wilcoxon			P=0.028*	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.046*			

*Paired Student-t test * P<0.05, ** P<0.01

Table 4 Number of general bacteria on Kitchen knife Blade and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	24	7	7	1
2	8	15	15	3
3	64	18	18	3
4	32	40	40	32
5	49	39	39	1
6	1	7	7	7
Average value	29.7	21.0	21.0	7.8
SD	24.0	15.0	15.0	12.0
F test	P=0.138		P=0.305	
Student-t*	P=0.348		P=0.059	
Wilcoxon				
F test	P=0.059			
Student-t*	P=0.108			
Wilcoxon				

*Paired Student-t test * P<0.05, ** P<0.01

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The results of the microbial stamp test showed that the number of bacteria did not change much after cooking and after washing. Still, the number of bacteria decreased after spraying with70%alcohol.

The results of the microbial stamp test (E Coli) show in Table 5 (kitchen knife handle) and Table 6 (kitchen knife blade). The results of the microbial stamp test showed that the number of bacteria changed much after cooking and after washing. But the number of bacteria did not decrease after spraying with 70%alcohol for the kitchen knife handle. The knife blade had a reduced number of microorganisms after 70%alcohol sprayings.

Table 5 Number of E. coli on Kitchen knife Handle and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	3	2	2	0
2	2	8	8	27
3	161	5	5	3
4	1	1	1	0
5	1	1	1	0
6	0	0	0	6
Average value	28.0	2.8	2.8	6.0
SD	65.2	3.1	3.1	10.6
F test	P=0.0001**		P=0.004**	
Student-t*				
Wilcoxon	P=0.593		P=0.0917	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.753			

*Paired Student-t test * P<0.05, ** P<0.01

Table 6 Number of E. coli on Kitchen knife Blade and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	2	2	2	1
2	1	0	0	1
3	163	60	60	0
4	0	0	0	0
5	2	1	1	0
6	0	0	0	0
Average value	28.0	10.5	10.5	0.3
SD	66.1	24.3	24.3	0.5
F test	P=0.014*		P=0.0001**	
Student-t*				
Wilcoxon	P=0.109		P=273	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.109			

*Paired Student-t test * P<0.05, ** P<0.01

The results of the microbial stamp test (Staphylococcus aureus) show in Table 7 (kitchen knife handle) and Table 8 (kitchen knife blade). The results of the microbial stamp test showed that the number of bacteria did not change much after cooking and after washing,. Still, the number of bacteria decreased after spraying with 70%alcohol.

Table 7 Number of Staphylococcus aureus on Kitchen knife Handle and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	9	1	1	0
2	7	9	9	5
3	0	1	1	10
4	0	1	1	2
5	26	1	1	70
6	9	12	12	11
Average value	8.5	4.2	4.2	16.3
SD	9.5	5.0	5.0	26.6
F test	P=0.071		P=0.0001**	
Student-t*	P=0.374			
Wilcoxon			P=0.600	
F test	P=0.012*			
Student-t*				
Wilcoxon	P=0.345			

*Paired Student-t test * P<0.05, ** P<0.01

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Table 8 Number of Staphylococcus aureus on Kitchen knife Blade and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	21	0	0	0
2	30	136	136	0
3	1	250	250	2
4	117	2	2	0
5	29	4	4	0
6	0	3	3	0
Average value	33.0	65.8	65.8	0.3
SD	43.2	104.9	104.9	0.8
F test	P=0.024*		P=0.0001**	
Student-t*				
Wilcoxon	P=0.917		P=0.043*	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.080			

*Paired Student-t test * P<0.05, ** P<0.01

The results of the microbial stamp test (Salmonella) show in Table 9 (kitchen knife handle) and Table 10 (kitchen knife blade). The results of the microbial stamp test showed that the number of bacteria changed much after cooking and after washing. And the number of bacteria decreased after spraying with 70%alcohol.

Table 9 Number of Salmonella on Kitchen knife Handle and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	3	0	0	0
2	0	11	11	1
3	0	1	1	0
4	0	0	0	0
5	42	0	0	0
6	17	0	0	0
Average value	10.3	2.0	2.0	0.2
SD	16.9	4.4	4.4	0.4
F test	P=0.0001**		P=0;0001**	
Student-t*				
Wilcoxon	P=-.0.128		P=0.180	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.144			

*Paired Student-t test * P<0.05, ** P<0.01

Table 10 Number of Salmonella on Kitchen knife Blade. and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	2	0	0	0
2	24	5	5	1
3	0	0	0	0
4	1	0	0	0
5	47	1	1	0
6	25	0	0	0
Average value	16.5	1.0	1.0	0.2
SD	18.9	2.0	2.0	0.4
F test	P=0.0001**		P=0.001**	
Student-t*				
Wilcoxon	P=0.43*		P=0.180	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.043*			

*Paired Student-t test * P<0.05, ** P<0.01

The results of the microbial stamp test (Vibrio parahaemolyticus) show in Table 11 (kitchen knife handle) and Table 12 (kitchen knife blade). The results of the microbial stamp test showed that the number of bacteria changed much after cooking and after washing. And the number of bacteria decreased after spraying with 70%alcohol.

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Table 11 Number of Vibrio parahaemolyticus on Kitchen knife Handleand statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	0	0	0	0
2	0	27	27	0
3	102	0	0	0
4	0	0	0	2
5	37	1	1	3
6	0	0	0	1
Average value	23.2	4.7	4.7	1.0
SD	41.4	10.9	10.9	1.3
F test	P=0.003**		P=0.0001**	
Student-t*				
Wilcoxon	P=0.285		P=0.715	
F test	P=0.0001**			
Student-t*				
Wilcoxon	P=0.465			

*Paired Student-t test * P<0.05, ** P<0.01

Table 12 Number of Vibrio parahaemolyticus on Kitchen knife Blade and statistical processing result

	No alcohol treatment		Alcohol treatment	
For meat	Before washing	After washing	After washing	After alcohol
1	1	0	0	0
2	0	0	0	0
3	1	1	1	0
4	0	0	0	0
5	0	0	0	0
6	4	1	1	1
Average value	1.0	0.3	0.3	0.2
SD	1.5	0.5	0.5	0.4
F test	P=0.009**		P=0.291	
Student-t*			P=363	
Wilcoxon	P=0.180			
F test	P=0.002**			
Student-t*				
Wilcoxon	P=0.109			

*Paired Student-t test * P<0.05, ** P<0.01

IV. Discussion

In the previous research report, we were able to reduce the ATP value to 100 or less by washing the handle and blade of the knife with running water for 30 seconds or more[1]. This time, we further examined hygiene management using alcohol to protect the safety and security of meals, even in an environment where COVID-19 is prevalent. It is costly to manage the hygiene of the handle and blade of the kitchen knife using 70% alcohol, but we thought that it would be safer. In addition to the ATP test, a microbial stamp test was also performed at the same time to confirm whether food poisoning bacteria were reduces. As a result, in most cases, the number of bacteria decreased after spraying 70%alcohol as compared with after washing. In Escherichia coli (E. Coli) and Staphylococcus aureus, the number of bacteria increased after 70%alcohol sprayings on the knife blade compared with after washing. We think it is necessary to spray alcohol more firmly. Many reports have been made on ATP wiping tests for hospital meals[2,3] and business meals[4,5]. Hygiene education is provided by instructing cooks on the hygienic handling of cooking utensils[6,7]. In addition to the ATP wiping test[8,9], we believe that cooking utensils can handle more hygienically by conducting a microbial stamp test at the same time.

V. Conclusions

Microbial tests performed on the handles and blades of kitchen knives in kitchens where hygienic handling is required, after cooking, cleaning, and spraying with 70%alcohol. ATP wiping test and microbial stamp test used for the test. As a result, it found that the number of microorganisms decreased after70% alcohol spraying, but E. Coli and Staphylococcus aureus did not decrease simply. In the future, we would like to report the results of sterilizing the handle and blade of the kitchen knife by spraying70% alcohol more firmly.

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