

# Comparison of 70% Alcohol Disinfection and Sodium Hypochlorite Acid Disinfection on Kitchen Knife Blades, Handles and Cutting Boards

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## ABSTRACT

**Purpose:** In hygiene management in the kitchen, it is important to disinfect kitchen knives and cutting boards, which are often touched by human hands and food. It has become with COVID-19, and there is a demand for even more hygienic kitchen utensils. However, had to lack of supplies, there were times when it was difficult of obtain 70% alcohol, so the kitchen was temporarily disinfected with sodium hypochlorite. This time, we compared the results of ATP wiping inspections on the blade and handle (stainless steel) of kitchen knives and cutting board (plastic) that were disinfected with sodium hypochlorite obtained by electrolysis of salt water or 70% alcohol disinfection. We will report that obtained the target basics-hygiene data.

**Materials and Methods:** Using 6 kitchen knives, just after cooking and after cleaning the blade and handle of kitchen knife and after alcohol disinfection and sodium hypochlorite disinfection, use kikkoman's simple ATP wiping test kit to obtain the ATP value. As same as, of 12 cutting boards, just after cooking and after washing the cutting boards and after alcohol disinfection and sodium hypochlorite disinfection, use kikkoman's simple ATP wiping test kit to obtain the ATP value.

**Results:** As a result, in all tests, the ATP value was lower after washing than before washing in a series of investigations. In addition, there was no statistically significant difference between after washing and after disinfection in a series of investigations. However, the ATP value after disinfection was 100 or less, which met the standard value for hygienic handling. In addition, there was no statistically significant difference in the comparison of ATP values between the blade and handle of the kitchen knife after disinfection with 70% alcohol and after disinfection with sodium hypochlorite. On the cutting board, there is a statistically significant difference in ATP value after 70% alcohol disinfection and sodium hypochlorite disinfection, indication that the ATP value after alcohol disinfection is lower than that after sodium hypochlorite disinfection.

**Discussion:** Both after 70% alcohol disinfection and after sodium hypochlorite disinfection, the ATP value was 100 or less, which met the standard value for hygienic handling. However, we think that 70% alcohol disinfection is good according to HACCP as much as possible. Since there is a possibility of shortage of supplies in the event of an emergency in the future, considering the reduction of running costs and considering the effectiveness of sodium hypochlorite disinfection, it is recommended to use it in combination with 70% alcohol disinfection.

**KEYWORDS:** ATP wiping inspection; Microbial test; Cutting board; Knife blade; Knife handle

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## INTRODUCTION

Regarding the hygiene management of kitchens, it was required to strictly adhere to HACCP, but from June 2021, it became mandatory to fully introduce it to food-related business formats. This forced the stricter hygiene control in the kitchen. It will be with corona from 2020, and hygienic behavior was required by putting more effort into hand hygiene and disinfection of cooking utensils. Although it was temporary, it became difficult to obtain 70% alcohol for disinfection, and there was a time when the kitchen was cleaned using sodium hypochlorite obtained by electrolyzing saline solution. Sodium hypochlorite is also frequently used in kitchens because it is also used to sterilize foods (vegetables, etc.). Therefore, it was possible to use it without any resistance for washing the inside of the kitchen with sodium hypochlorite. However, it is not clear how hygienic it is compared to 70% alcohol.

## PURPOSE

Therefore, some study compared the effects of 70% alcohol and sodium hypochlorite on the disinfection of kitchen knives and cutting boards, which are often touched by human hands and food in the kitchen, using ATP values, and it is still less clear. This study is the aim to get basic data on the effects of 70% alcohol disinfection and sodium hypochlorite disinfection on the hygiene.

## MATERIALS AND METHODS

The ATP values were obtained by performing an ATP wiping inspection on the blades and handles of the six kitchen knives

## RESULTS

**Table 1:** ATP value of the blade of 6 kitchen knives after 70% alcohol disinfection.

	Before Washing	After Washing	After 70% Alcohol Disinfection
	17043	71	12
	99427	154	20
	62623	398	13
	44331	421	88
	113059	28	57
	235282	179	21
Average	88627.5	209.5	35.2
Standard Deviation (SD)	78383.5	164.2	30.7
Median	61025	166.5	20.5
Maximum value	235282	421	88
Minimum value	17043	421	12

Table 1 shows the results of the tables of the blades of six knives that have been sterilized with 70% alcohol. The results of the ATP wipe test value performed immediately after cooking, the ATP wipe test value result performed after washing, and the ATP wipe test value result performed after 70% alcohol disinfection are shown. Compared to before washing, the removal rate was 99.7% after washing, and by disinfecting with alcohol, the removal rate was 99.96% compared to before washing. The removal rate after alcohol disinfection was 83.19% compared to that after washing.

immediately after cooking and before washing using an ATP inspection kit manufactured by Kikkoman. After further washing, the ATP value was obtained in the same manner. After that, 70% alcohol disinfection or sodium hypochlorite disinfection was performed, and the ATP value was obtained in the same manner. On 12 cutting boards, the ATP value before cleaning after cooking was inspected by wiping with ATP using a Kikkoman Lumitester and Lucipac. After further washing, the ATP value was obtained in the same manner. After that, alcohol disinfection or sodium hypochlorite disinfection was performed, and the ATP value was obtained in the same manner. The obtained data was statistically calculated using Excel statistics (SSRI Co., Ltd.). In a series of tests (before washing, after washing, after disinfection), F-test was performed for the purpose of examining the presence or absence of a normal distribution for the first two groups to be compared. As a result, if there was no significant difference, it was normally distributed, so the paired student-t test was performed. If there was a significant difference, it was not normally distributed, so statistical processing was performed using the paired Wilcoxon test. In order to compare the ATP values of alcohol disinfection and sodium hypochlorite disinfection, F-test was performed for the purpose of examining the presence or absence of a normal distribution for the two groups to be compared. As a result, if there is no significant difference, it is normally distributed, so the unpaired Student-t test was performed. In addition, if there is a significant difference, the distribution is not normally distributed, so statistical processing was performed using the unpaired Mann-Whitney test.

Table 2 shows the results of the blades of six kitchen knives that have been disinfected with sodium hypochlorite. The results of the ATP wipe test value performed immediately after cooking, the ATP wipe test value result performed after washing, and the ATP wipe test value result performed after sodium hypochlorite disinfection are shown. Compared to before washing, the removal rate was 99.91% after washing, and by disinfecting with sodium hypochlorite, the removal rate was 99.94% compared to before washing. The removal rate after sodium hypochlorite disinfection was 33.98% compared to that after washing.

**Table 2:** ATP value of the blade of 6 kitchen knives after sodium hypochlorite disinfection.

	Before Washing	After Washing	After Sodium Hypochlorite Disinfection
	119510	159	82
	60608	39	88
	33921	55	iw
	30693	8	16
	20121	104	25
	164381	6	23
Average	71539	61.8	40.8
Standard Deviation (SD)	57909.7	59.7	34.6
Median	47264.5	47	24
Maximum value	164381	159	88
Minimum value	20121	6	11

**Table 3:** ATP value of the handle of 6 kitchen knives after 70% alcohol disinfection.

	Before Washing	After Washing	After 70% Alcohol Disinfection
	10542	60	16
	2761	57	18
	3862	76	59
	28262	137	77
	1606	12	5
	37885	56	68
Average	14153	66.3	40.5
Standard Deviation (SD)	15286.7	40.7	31
Median	7202	58.5	38.5
Maximum value	37885	137	770
Minimum value	1606	12	5

Table 3 shows the results of the handles of six knives that have been sterilized with 70% alcohol. The results of the ATP wipe test value performed immediately after cooking, the ATP wipe test value result performed after washing, and the ATP wipe test value result performed after 70% alcohol disinfection are shown.

Compared to before cleaning, the removal rate was 99.53% after washing, and by disinfecting with alcohol, the removal rate was 99.70% compared to before washing. The removal rate after alcohol disinfection was 38.91% compared to that after washing.

**Table 4:** ATP value of the handle of 6 kitchen knives after sodium hypochlorite disinfection.

	Before Washing	After Washing	After Sodium Hypochlorite Disinfection
	1462	264	68
	93057	16	4
	5652	17	32
	525	5	43
	522	9	24
	4103	6	8
Average	17553.5	52.8	298
Standard Deviation (SD)	37046.8	103.6	23.7
Median	2782.5	12.5	28
Maximum value	93057	264	68
Minimum value	522	5	40

Table 4 shows the results of the handles of six kitchen knives that have been disinfected with sodium hypochlorite.

The results of the ATP wipe test value performed immediately after cooking, the ATP wipe test value result performed after washing, and the ATP wipe test value result performed after sodium hypochlorite disinfection are shown.

Compared to before cleaning, the removal rate was 99.69% after washing, and by disinfecting with sodium hypochlorite, the removal rate was 99.83% compared to before washing. The removal rate after sodium hypochlorite disinfection was 43.56% compared

to that after washing.

Since it was shown that the ATP value was considerably low before and after washing, and 70% alcohol disinfection or sodium hypochlorite disinfection, it was examined whether there was a statistically significant difference. The ATP values of 70% alcohol-sterilized kitchen knife blades were statistically compared. As a result, the ATP value was statistically significantly lower after washing than before washing ( $P<0.05$ ), after 70% alcohol disinfection than before washing ( $P<0.05$ ), and after 70% alcohol disinfection than after washing ( $P<0.05$ ) (Table 5).

**Table 5:** Comparison of ATP values of knife blades disinfected with 70% alcohol.

	Before Washing	After Washing	Before Washing	After 70% Alcohol Disinfection	After Washing	After 70% Alcohol Disinfection
Average values of 6 knives	88627.5	209.5	88627.5	35.2	209.5	35.2
Standard Deviation (SD)	78383.5	164.2	78383.5	30.7	164.2	30.7
F-Test	0.0001**		0.0001**		0.0001**	
Pair Student-T						
Wilcoxon	0.028*		0.028*		0.046*	

The ATP values of sodium hypochlorite disinfection sterilized kitchen knife blades were statistically compared. As a result, the ATP value was statistically significantly lower after washing than before washing ( $P<0.05$ ), after sodium hypochlorite disinfection

than before washing ( $P<0.05$ ). But, after sodium hypochlorite disinfection than after washing was not statistically significantly different ( $P>0.05$ ) (Table 6).

**Table 6:** Comparison of ATP values of knife blades disinfected with sodium hypochlorite.

	Before Washing	After Washing	Before Washing	After Sodium Hypochlorite Disinfection	After Washing	After Sodium Hypochlorite Disinfection
Average Values of 6 Knives	71539	61.8	71539	40.8	61.8	40.8
Standard Deviation (SD)	57909.7	59.7	57909.7	34.6	59.7	34.6
F-Test	0.0001**		0.0001**		0.106	
Pair Student-T						
Wilcoxon	0.028*		0.028*		0.463	

The ATP values of 70% alcohol-sterilized kitchen knife handles were statistically compared. As a result, the ATP value was statistically significantly lower after washing than before washing

( $P<0.05$ ), after 70% alcohol disinfection than before washing ( $P<0.05$ ). But, after 70% alcohol disinfection than after washing was not statistically significantly different ( $P>0.05$ ) (Table 7).

**Table 7:** Comparison of ATP values of knife handles disinfected with 70% alcohol.

	Before Washing	After Washing	Before Washing	After 70% Alcohol Disinfection	After Washing	After 70% Alcohol Disinfection
Average Values of 6 Knives	14153	66.3	14153	40.5	66.3	40.5
Standard Deviation (SD)	15286.7	40.7	15286.7	31	40.7	31
F-Test	0.0001**		0.0001**		0.262	
Pair Student-T						
Wilcoxon	0.028*		0.028*		0.063	

The ATP values of sodium hypochlorite disinfection sterilized kitchen knife handles were statistically compared. As a result, the ATP value was statistically significantly lower after washing than before washing ( $P < 0.05$ ), after sodium hypochlorite disinfection

than before washing ( $P < 0.05$ ). But, after sodium hypochlorite disinfection than after washing was not statistically significantly different ( $P > 0.05$ ) (Table 8).

**Table 8:** Comparison of ATP values of knife handles disinfected with sodium hypochlorite.

	Before Washing	After Washing	Before Washing	After Sodium Hypochlorite Disinfection	After Washing	After Sodium Hypochlorite Disinfection
Average Values of 6 Knives	17553.5	52.8	17553.5	29.8	52.8	29.8
Standard Deviation (SD)	37046.8	103.6	37046.8	23.7	103.6	23.7
F-Test	0.001**		0.0001**		0.001**	
Pair Student-T						
Wilcoxon	0.028*		0.028*		0.6	

Next, the ATP values of 70% alcohol disinfection and sodium hypochlorite disinfection were statistically compared. As a result, the knife blades were compared before, after and after disinfection,

respectively, but there was no statistically significant difference in any of the cases ( $P > 0.05$ ); (Table 9).

**Table 9:** Comparison of ATP values of knife handles when disinfected with sodium hypochlorite and when disinfected with 70% alcohol.

	Before Washing	Before Washing	After Washing	After Washing	After 70% Alcohol Disinfection	After Sodium Hypochlorite Disinfection
Average Values of 6 Knives	14153	17553.5	66.3	52.8	40.5	29.8
Standard Deviation (SD)	15286.7	37046.8	40.7	103.6	31	23.7
F-Test	0.024*		0.019**		0.266	
Pair Student-T						
Mann-Whitney	0.333		0.107		0.158	

Similarly, about the handle of the kitchen knife, the ATP values of 70% alcohol disinfection and sodium hypochlorite disinfection were statistically compared. As a result, the knife handles were

compared before, after and after disinfection, respectively, but there was no statistically significant difference in any of the cases ( $P > 0.05$ ) (Table 10).

**Table 10:** Comparison of ATP values of kitchen knife handles when disinfected with sodium hypochlorite and when disinfected with 70% alcohol.

	Before Washing	Before Washing	After Washing	After Washing	After 70% Alcohol Disinfection	After Sodium Hypochlorite Disinfection
Average Values of 6 Knives	88627.5	71539	209.5	61.8	35.2	40.8
Standard Deviation (SD)	78383.5	57909.7	164.2	59.7	30.7	34.6
F-Test	0.24		0.013*		0.39	
Unpair Student-T						
Mann-Whitney	0.0677		0.076		0.771	

Next, Table 11 shows the results of 70% alcohol disinfection of 12 cutting boards. The ATP value that was wiped and inspected after cooking and before washing was compared with the ATP value that was wiped and inspected after washing and the ATP value that was wiped and inspected after 70% alcohol disinfection.

The removal rate after washing was 99.92% compared to before washing, and the removal rate was 99.97% after washing by 70% alcohol disinfection. The ATP value was 68.05% after 70% alcohol disinfection compared to before washing.

**Table 11:** ATP value result of cutting board disinfected with 71% alcohol.

No	Before Cleaning	After Cleaning	After 70% Alcohol Disinfection
1	97008	79	99
2	3845	46	9
3	13534	11	7
4	22	31	4
5	161528	24	23
6	2426	21	26
7	10560	2	4
8	52457	30	7
9	247	11	8
10	6380	60	1
11	105196	16	7
12	24432	44	5
Average	39802.9	31.3	10
Standard deviation	53310	22.5	8.1
Median	12047	27	7
Maximum value	161528	79	26
Minimum value	22	2	1

Table 12 shows the results of sodium hypochlorite disinfection of 12 cutting boards. The ATP value that was wiped and inspected after cooking and before washing was compared with the ATP value that was wiped and inspected after washing and the ATP value that was wiped and inspected after sodium hypochlorite disinfection.

The removal rate after washing was 99.95% compared to before washing, and the removal rate was 99.94% after washing by sodium hypochlorite disinfection. The ATP value was 22.33% after sodium hypochlorite disinfection compared to after washing.

**Table 12:** ATP value result of cutting board disinfected with sodium hypochlorite.

No	Before cleaning	After cleaning	After sodium hypochlorite disinfection
1	477363	66	16
2	7835	23	7
3	131235	3	74
4	10346	4	70
5	29672	23	41
6	835	23	47
7	6945	13	25
8	119	5	54
9	58434	1	33
10	37628	165	24
11	32121	21	62
12	2780	24	1
Average	66276.1	30.9	37.8
Standard deviation	134622.5	45.7	24.2
Median	20009	22	37
Maximum value	477363	165	74
Minimum value	119	1	1

The ATP values of 70% alcohol-sterilized cutting boards were statistically compared. As a result, the ATP value was statistically significantly lower after washing ( $P<0.01$ ) than before washing,

after 70% alcohol disinfection than before washing ( $P<0.01$ ), and after 70% alcohol disinfection than after washing ( $P<0.05$ ) (Table 13).

**Table 13:** Statistical comparison of ATP values for 70% alcohol sterilized cutting boards.

	Before Washing	After Washing	Before Washing	After 70% Alcohol Disinfection	After Washing	After 70% Alcohol Disinfection
Average Values of 12 Cutting Board	39802.9	31.3	39802.9	10	31.3	10
Standard Deviation (SD)	53310	22.5	53310	8.1	22.5	8.1
F-Test	0.0001**		0.0001**		0.001**	
Pair Student-T						
Wilcoxon	0.003**		0.002**		0.012*	

The ATP values of sodium hypochlorite -sterilized cutting boards were statistically compared. As a result, the ATP value was statistically significantly lower after washing ( $P<0.01$ ) than before washing, after sodium hypochlorite disinfection than before

washing ( $P<0.01$ ). However, there was no statistically significant difference after sodium hypochlorite disinfection than after washing ( $P<0.05$ ) (Table 14).

**Table 14:** Statistical comparison of ATP values for sodium hypochlorite sterilized cutting boards.

	Before Washing	After Washing	Before Washing	After Sodium Hypochlorite Disinfection	After Washing	After Sodium Hypochlorite Disinfection
Average Values of 12 Cutting Board	66276.1	30.9	66276.1	37.8	30.9	37.8
Standard Deviation (SD)	134622.5	45.7	134622.5	24.2	45.7	24.2
F-Test	0.0001**		0.0001**		0.018*	
Pair Student-T						
Wilcoxon	0.0001**		0.002**		0.347	

For cutting boards, the ATP values of 70% alcohol disinfection and sodium hypochlorite disinfection were statistically compared. As a result, the results before and after each washing were compared, but there was no statistically significant difference in

either case ( $P>0.05$ ). However, it was shown that the ATP value was statistically significantly lower after 70% alcohol disinfection and after sodium hypochlorite disinfection ( $P<0.01$ ) (Table 15).

**Table 15:** Statistical comparison of ATP values for cutting boards disinfected with 70% alcohol and sodium hypochlorite.

	Before Washing	Before Washing	After Washing	After Washing	After 70% Alcohol Disinfection	After Sodium Hypochlorite Disinfection
Average Values of 12 Cutting Board	66276.1	39802.9	30.9	31.3	37.8	10
Standard Deviation (SD)	134622.5	53310	45.7	22.5	24.2	8.1
F-Test	0.002**		0.010*		0.0001**	
Pair Student-T						
Wilcoxon	0.772		0.297		0.004**	

## DISCUSSION

Many researchers have achieved hygiene management in hospitals and other kitchens through hygiene education [1-4]. In particular, hygiene management using the ATP wiping test made it possible to create an easy-to-understand and hygienic environment by expressing invisible microorganisms as ATP values [5-8]. In

the past, we also reported the results of hygiene tests on kitchen utensils using ATP wiping test [9-11].

From the above, washing itself is very important in hygiene management of kitchen knife blades and handles those human hands touch, and cutting boards that food frequently touches, and 70% alcohol disinfection and sodium hypochlorite disinfection are effective. In kitchen knives, both 70% alcohol and sodium



hypochlorite had an ATP value of 100 or less after disinfection, indicating that they meet hygiene standards. Furthermore, on cutting boards, 70% alcohol disinfection was shown to reduce ATP levels statistically significantly more than sodium hypochlorite disinfection. As shown in the HACCP manual, this study also showed that disinfection with 70% alcohol was effective, but sodium hypochlorite was also effective. Sodium hypochlorite, which is produced by electrolysis from saline solution, is low cost than 70% alcohol. In the kitchen, it is necessary to devise ways to reduce running costs by using two types of disinfectants properly according to the amount of work. It is considered effective to maintain a hygienic environment flexibly by constantly disinfecting with inexpensive sodium hypochlorite and performing 70% alcohol disinfection based on HACCP when washing cooking ware. In the event of a shortage of supplies that may occur again in the future, it is necessary to hedge the risk of disinfection methods. For that purpose, we would like to promote the combined use of 70% alcohol and sodium hypochlorite. With this method, it is considered that hygiene management for providing safe and secure meals can be sufficiently performed while suppressing running costs. We want to use it for hygiene management in the kitchen in the future.

## CONCLUSION

It was found that both 70% alcohol and sodium hypochlorite statistically significantly reduce the ATP values of kitchen knife blades, handles and cutting boards. It was also shown that both 70% alcohol and sodium hypochlorite are inferior disinfection methods. According to HACCP, disinfection with 70% alcohol at the main important control points will be continued, and it is considered that the hygiene management of the kitchen incorporating sodium hypochlorite disinfection in consideration of running cost in other parts will be useful in the future.

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