

Analysis and Control of Coriander and Cucumbers in Tossed Salad

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Abstract: The tossed green salad has been made of coriander and cucumbers evenly mixing with soy sauce, garlic, hot pepper oil and salt. The paper analyzes the changes of bacteriology of the tossed green salad in its process and refrigerated. The results showed the Colony Forming Units (CFU) in salad was 3.6×10^5 CFU/g, coriander contributed to 83.33% of bacterial count, and cucumbers was 16.11%. However, after coriander and cucumbers were scalded, CFU in them were lowered by 99.86% and 97.93%. It showed the storage period of such tossed salad increased from 2d to 5d when it was stored at 4°C, the research proves practical value and it benefit to the food safety management of the catering industry.

Key words: tossed salad; CFU; bacterial phases; storage period

1. Introduction

Tossed green salad, which after the vegetables are preliminary made, mixed with some ingredients and seasoning, it can be made a delicious product. Its primary characteristic including easily manufactured, bright color, nourished the stomach and healthy ^[1]. Because of the high temperature in summer, the microorganism will be multiplied rapidly, and then it begins rotting and putrefying easily, it is various ingredients of tossed green salad ^[2]. In recent years, the food hygiene and the food storage date of the tossed green salad should be paid more attention. Fresh vegetables ingredients should be washed with clean water. If the tossed green salad are made by putrid vegetables and the inexhaustive disinfection, which would lead gastrointestinal diseases when someone ate such kind of salad, so the tossed green salad should be made by mostly fresh vegetables or fruits, then the process must cut immediately. Owing to a majority of the ingredients are high moisture and nutrient-rich, it is beneficial to the growth of microorganisms under the suitable condition, it is almost impossible for the tossed green salad in the course of processing and edible process to implement thermization. While it can make the tossed green salad retains the nutrients in raw materials as far as possible, the same as the food safety and health cannot assure, consequently, the risk of food poisoning is serious. As a result, the tossed green salad must be used of fresh vegetables or fruits, and then wash them clean. It is better to use scalding water, because of such kind of water could exterminate some residual bacteria and parasites. Without any doubt, eating salad causes food poisoning and food-borne parasitic diseases reported constantly. For example, eating turnip strip in tossed salad caused Escherichia coli colitis in Japan ^[3]. Likewise in America, Salmonella poisoning caused by raw spinach. The security of this kind of food caused widely public concerns, parts of our country have been formulated the local quality standard. Unfortunately it is imperfect. However, owing to lack of decision criteria in some study reports, the marinated meat always to be as a reference to evaluate appears far-fetched. Hence, establish relevant product quality control and evaluation system, evaluate the quality of this kind of food hygiene to ensure the safety of the food business, they are urgently.

The tossed green salad are made of coriander and cucumbers evenly mixed with soy sauce, hot pepper oil, garlic and salt. The paper analyzes the changes of bacteriology of the tossed green salad in its processed and refrigerate. Accordingly it could form the processing technology of food safety to improve the storage period of tossed green salad ^[4]. In this study, pay more attention to the microbial pollution during the food product and refrigerate, the health quality change the relative control techniques.

2 Materials

2.1 Ingredients

Coriander, cucumbers, soy sauce, hot pepper oil, garlic, salt, all of the condiments were bottled or bagged products and bought from Tesco supermarket in Yang Zhou.

2.2 Reagents

The reagents included beef extract, peptone, yeast extract, glucose, lactose, D-mannitol, agar, bile salts, Fan red; NaCl, NaOH, I₂, KI, Bile and anhydrous magnesium chloride, anhydrous potassium sulfate, magnesium sulfate,

manganese sulfate, calcium carbonate, hydrogen phosphate, dipotassium and diammonium citrate, sodium acetate, ethanol, AR grade; Gram staining solution configured according to the literature.

2.3 Culture media

Nutrient agar, all of these are for the separation and the counting of the total bacterial colonies. PSA medium, the culture conditions is for the separating and counting of the *Pseudomonas*. MRS medium, the culture conditions is for isolation and counting of the Lactic Acid bacteria. VRBGA medium, the culture conditions is for isolation and counting of the Enterobacteriaceae^[5].

2.4 Equipment

XS-18 biological microscope, DT-200 Electronic Balance, pHS-3C pH meter, DFG30/HG101 electric blast drying oven, HG303 type electric drying incubator, Automatic electric pressure LDZX-40B2 vertical steam sterilizer, Adjustable million electric furnace, BCD-195WIV refrigerator, HH-8 number substantially constant temperature water bath Electric Appliance, SW-CJ-1F type clean bench, pH 5.5-9.0 Precision dipstick.

3 Methods

3.1 Protocol of a basic formula of coriander and cucumbers in tossed salad

A basic formula of coriander and cucumbers in tossed salad according to the literature is given in Table 1^[6].

Tab. 1 Basic formula of coriander and cucumbers in tossed salad

Materials	Coriander	Cucumber	Soy sauce	Hot pepper oil	Garlic	Salt
Usage amount (g)	500	100	8	3	5	5

3.2 Preparation of coriander and cucumbers in tossed salad samples

Wash coriander and cucumbers, cut them into section; add soy sauce, hot pepper oil, garlic and salt into bowls and mix all ingredients listed above. The preparation is done.

3.3 Coriander and cucumbers in tossed salad contamination investigation and the source analysis

Sample the raw materials and the finished goods of respectively 25g with sterile procedure. Make 1:10 incremental dilution, 1mL pour plate. Make two plates for each dilution, pour nutrient agar approximately at 45 °C 15mL, and rotate the dish to mix the solution; solidify the medium and then invert the medium in the incubator at 37 °C for 24h, then get it out and count^[7].

3.4 Control of the number of bacteria in coriander and cucumbers in tossed salad

Put the coriander and cucumbers into boiled water, keep for 30 seconds and take statistics of the rate of bacteria reduction.

3.5 The Change in health quality of the coriander and cucumbers during refrigeration

Make the unit of 25g tossed green salad samples respectively by the basis recipe and improved formulation, place the unit placed in a sterile petri dish, cool and preserve them at 4 °C refrigerator, and get them out per 24h, by time sequence measure the number of bacteria and graph the growth curve. Do sensory test of the product at the same time, to evaluate the quality of their health, by which the salad shelf life is built^[8].

3.6 Measure the changes of bacteria count

Measured *Pseudomonas* number, the number of Enterobacterium and Lactic Acid bacteria, and observe all kinds of the changes of bacteria content.

3.7 Microflora analysis

Based on all kinds of bacteria count, statistics the percentage of the microflora, reveals the changes of bacteria count.

3.8 The hygienic quality changes of food in the process of refrigeration

Observed samples of the tossed green salad about the changes of the color, taste, smell, evaluate the quality of their health, and formulate reference storage period.

4 Results and Analysis

4.1 Contaminate investigation and the source analysis of coriander and cucumbers

The number of bacteria in raw materials and finished product are given in Table 2.

Tab.2 The result of measuring the number of coriander and cucumbers bacteria

Products	Weight(g)	Time(min)	The total number of bacterial colonies(CFU/g)
Coriander	500	5	3.0×10^5
Cucumber	100	3	5.8×10^4
Finished products	621	15	3.6×10^5

As shown in Table 2, the number of bacterial colonies of coriander and cucumbers are 3.0×10^5 CFU/g and 5.8×10^4 CFU/g.

The bacterial number which have different types of raw material are the variable, usage amount of weight. The total bacterial count of the product by the basic formula is 3.6×10^5 CFU/g; coriander occupies 83.33%, while cucumbers occupies 16.11%.

The coriander and cucumbers are growing in soil, they always polluted by manure and sewage, therefore they have high quantity of pathogen.

4.2 Control the number of bacteria about the coriander and cucumbers

The changes of the number of the bacteria in raw ingredients after 30 seconds boiling are shown in Table 3.

Tab.3 The changes of bacteria count after blanching

Items	The total number of bacterial colonies(CFU/g)	Total number of bacterial colonies after blanching(CFU/g)	Bacteria reduction(%)
Coriander	3.0×10^5	4.1×10^2	99.86
Cucumber	5.8×10^4	1.2×10^3	97.93
Finished production	3.6×10^5	5.3×10^2	99.85

According to the data in Table 3, the bacteria reduction after blanching is recorded, and the most significant are coriander which gives 99.86%. Meanwhile, the cucumbers alone recorded 97.93% reduction in bacteria, and the finished production showed 99.85% reduction. It reflects that blanching is a very effective means of reducing bacteria, which played an important role in controlling the bacteria number of the coriander and cucumbers in tossed green salad.

The coriander and cucumbers in tossed green salad of bacterial protein, nucleic acid and enzyme system are damaged by blanching, the weak hydrogen bonds in proteins is easily heated damage, make the protein denaturation of solidification, thus it reveals sterilization effect.

4.3 The effect of heating to the finished product of bacteria reduction rate of various types of bacteria

The changes of the all kinds of the bacteria in coriander and cucumbers in tossed salad after 30 seconds boiling are shown in Table 4.

Tab.4 The changes of various types of bacteria count after blanching

Bacterial species	The total number of bacterial colonies(CFU/g)	Total number of bacterial colonies after blanching(CFU/g)	Bacteria reduction(%)
<i>Pseudomonas</i>	8.8×10^3	2.0×10^2	97.73
<i>Enterobacter</i>	3.6×10^4	4.5×10^2	98.75
<i>Lactic Acid</i>	3.2×10^4	5.5×10^3	82.81

Table 4 shows that blanching to the coriander and cucumbers in tossed salad for the various types of bacteria of the bacteria reduction rate, they are different. *Enterobacter* among them is 98.75%, the *Pseudomonas* is 97.73%, the *Lactic Acid* is 82.81%.

Because the cellular structure features and cellular composition of the all kinds of bacteria are different, so their bacteria reduction are different. For instant, *Enterobacter* is

Brevibacterium, there is no heat resistance. *Pseudomonas* is *psychrophile*, it is heat sensitive. *Lactic Acid* is gram positive bacteria, thermal resistance is stronger.

4.4 The Changes of the microbial flora in the process of the coriander and cucumbers storage

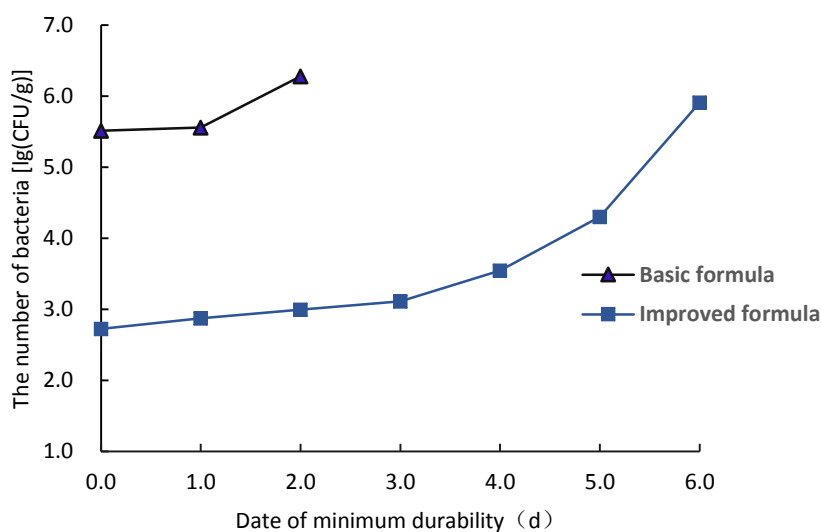


Fig.1 The changes for the number of bacteria during the refrigerated process of the finished product.

Figure 1 shows that refrigerated in 4°C by seven days, the number of bacteria in basic formula increase as wavy lines, reaching the peak value on the third day. Within four days, the improved formula is an order of magnitude lower than the basic formula, and four days later, the number of bacteria in basic formula and improved formula are rise until 6.28 [lg(CFU/g)] in basic formula and 5.91 [lg(CFU/g)].

4.5 Microflora analysis in the process of refrigeration

The changes for the number of microflora during the refrigerated process of coriander and cucumbers in Table 5.

Tab.5 The changes of microflora during the refrigeration

Storage period(d)	Microflora Composition (%)					
	Basic formula			Improved formula		
	<i>Pseudomonas</i>	<i>Lactic Acid bacteria</i>	<i>Enterobacter</i>	<i>Pseudomonas</i>	<i>Lactic Acid bacteria</i>	<i>Enterobacter</i>
0.0	83	16	1	63	34	3
1.0	87	11	2	64	34	2
2.0	85	14	1	65	34	1
3.0	-	-	-	66	33	1
4.0	-	-	-	74	25	1
5.0	-	-	-	74	25	1
6.0	-	-	-	72	26	2

Table 5 shows that, microflora composition in basic formula, *Pseudomonas* occupies 85%, *Lactic Acid bacteria* occupies 14%, *Enterobacter* occupies 1%, before two days of the storage period, the number of *Pseudomonas* increases, on the second day, it begins down, finally *Pseudomonas* occupies 85%.The number of *Lactic Acid bacteria* is decline in before second day, the last day is 14%, it is the second dominant bacteria except *Pseudomonas*. In the process of refrigeration, *Enterobacter* is in low proportion, the less changes of it. Eventually, *Pseudomonas* occupies 85%, *Lactic Acid bacteria* occupies 14%, *Enterobacter* occupies 1%.Obviously, at 4°C refrigerated, the coriander and cucumbers in tossed green salad of *Pseudomonas* and *Lactic Acid bacteria* are dominant bacteria. *Pseudomonas*, *Lactic Acid bacteria* and *Enterobacter* make the finished product go bad.

Finally, after blanching *Pseudomonas* occupies 72%, *Lactic Acid bacteria* occupies 26%, *Enterobacteria* occupies 2%.In storage, the number of *Pseudomonas* increase from first day to the fifth day reach 74%.On the last day of the storage, the proportion of *Pseudomonas* decreased reaching 72%.Although *Pseudomonas* is decreasing, it also dominant bacteria always. The proportion of *Lactic Acid bacteria* decrease on 25% until the fifth day. It has been the second dominant bacteria. The number of *Enterobacteria* from 1% to 2%.Finally, *Pseudomonas* occupies 72%, *Lactic Acid bacteria* occupies 26%, *Enterobacteria* occupies 2%.Obviously, at 4°C refrigerated, *Pseudomonas* and *Lactic Acid bacteria* can be made the finished products go bad.

4.6 The hygienic quality changes of food in the process of refrigeration

If followed from organoleptic examination, in 4°C refrigerated three days, the coriander and cucumbers in tossed salad of the basic formula had something rancidity, it cannot be eaten any more, therefore the basic formula was shelf life of one day. However, the improved formula could be stored five days, since the basic formula has been rancidity in three days. Indicate through the process of blanching, it can suppress the positive bacteria of *Pseudomonas* and *Lactic Acid* bacteria, in maintaining the health quality of coriander and cucumbers in tossed salad and prolong shelf life have played a key role control^[9].

5 Conclusions

According to the experiment data, the paper analyzes the changes of bacteriology of the tossed green salad in its processed and refrigerated. The results showed that the CFU in them was 3.6×10^5 CFU/g, coriander contributed to 83.33% of bacterial count, and cucumbers was 16.11%. *Pseudomonas* occupied 85%, *Lactic Acid* bacteria occupies 14%, *Enterobacteria* occupied 1%. The raw materials blanching for 30 seconds after, coriander and cucumbers are scalded, CFU in it were lowered by 99.86% and 97.9%. The percent reduction of bacteria of *Pseudomonas* was 97.73%, *Lactic Acid* bacteria 82.81%, *Enterobacteria* 98.75%. Blanching cannot changes microbial community structure anymore, but the storage period of such tossed salad increased from 2d to 5d when it was stored at 4°C, and our research proves the practical value^[10].

The technology of blanching to the coriander and cucumbers in tossed salad, could be applied in other similar food processing, which need further study.

6 References

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