PERIÓDICO TCHÊ QUÍMICA
ARTIGO ORIGINAL

O EFEITO DO ARMAZENAMENTO DE PRODUTOS ALIMENTÍCIOS ULTRACONGELADOS NAS SUAS CARACTERÍSTICAS DE QUALIDADE

THE EFFECT OF DEEP-FROZEN FOOD PRODUCT STORAGE ON THEIR QUALITY CHARACTERISTICS

تأثير الحفظ لمنتجات أغذية التجميد العميق على الصفات النوعية لها

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RESUMO

Introdução: Muitos mercados de alimentos na cidade de Bagdá sofrem com a falta de aplicação de boas práticas de higiene e padrões de segurança alimentar no manuseio de alimentos, especialmente no armazenamento de alimentos congelados. A implementação desses padrões e práticas promoverá a qualidade e segurança dos produtos alimentícios congelados e garantirá a segurança dos alimentos para o consumo. **Objetivo:** O objetivo deste estudo foi avaliar amostras de produtos alimentícios congelados coletadas aleatoriamente de diferentes lojas de alimentos em Bagdá. **Métodos:** Vinte produtos alimentícios congelados foram coletados aleatoriamente de lojas de alimentos em Bagdá, e suas características sensoriais e microbiológicas foram testadas no Laboratório de Microbiologia do Centro de Pesquisa de Mercado e Proteção ao Consumidor, de acordo com a norma iraquiana acreditada. **Resultados:** Os resultados obtidos demonstraram que, em média, 22,2% das amostras testadas não estavam em conformidade com o limite microbiológico da norma iraquiana para alimentos, e 55% apresentaram não conformidade média na avaliação sensorial. Discussão: Um alto percentual dos produtos alimentícios congelados selecionados falhou tanto na análise microbiológica quanto na análise sensorial, o que se deve à falta de práticas adequadas de manuseio de alimentos que as lojas de alimentos devem seguir. **Conclusão:** Muitos produtos alimentícios congelados oferecidos nas lojas de alimentos da cidade de Bagdá são produzidos sem a aplicação de boas práticas de higiene e padrões de segurança alimentar essenciais para o manuseio de alimentos em lojas de alimentos.

Palavras-chave: *segurança alimentar, lojas de alimentos, características microbiológicas e sensoriais.*

ABSTRACT

Background: Many food stores in Baghdad city suffered from a lack of the application of good hygiene practices and food safety standards in food handling that should be done regarding frozen food storage. The implementation of these standards and practices will promote the quality and safety of frozen food products and keep foods safe for consumption. **Aim:** The objective of this study was to evaluate frozen food product samples collected randomly from different food stores in Baghdad. **Methods:** Twenty frozen food products were drawn randomly from food stores in Baghdad, and both sensorial and microbial characteristics were tested at the Laboratory of Microbiology of the Market Research and Consumer Protection Center according to the accredited Iraqi standard. **Results:** Obtained results demonstrated that tested samples were, on average, 22,2% non-conformity with the Iraqi standard of microbiological limits in food and 55% as average non-conformity in sensorial assessment. **Discussion:** A high percentage of selected frozen food products failed in both microbial and sensorial analysis, and this referred to a lack of food handling practices that food stores should follow. **Conclusion:** Many frozen food products offered in food stores in Baghdad city are made without the application of good hygiene practices and food safety standards that are essential for food handling in food stores.

Keywords: *food safety, food stores, microbial and sensorial characteristics.*

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الملخص

الخلفية: عانت العديد من متاجر المواد الغذائية في مدينة بغداد من عدم تطبيق ممارسات النظافة الجيدة ومعايير السلامة الغذائية في التعامل مع المواد الغذائية التي ينبغي تطبيقها عند تخزين المواد الغذائية المجمدة. سيؤدي تنفيذ هذه المعايير والممارسات إلى تعزيز جودة وسلامة المنتوجات الغذائية المجمدة، والحفاظ على سلامة الأطعمة للمستهلك. **الهدف:** لذلك كان الهدف من هذه الدراسة هو تقييم عينات من المنتوجات الغذائية المجمدة التي تم جمعها عشوائيا من متاجر المواد الغذائية المختلفة في مدينة بغداد. **طرائق العمل:** تم سحب عشرين منتوجا غذائيا مجمدا, عشوائيا من متاجر المواد الغذائية في مدينة بغداد، وأجريت لها فحوصات الخصائص الحسية والميكروبيولوجية في مختبر الأحياء المجهرية التابع لمركز بحوث السوق وحماية المستهلك, ووفقا للمواصفة القياسية العراقية المعتمدة. **النتائج:** أظهرت النتائج التي تم الحصول عليها أن العينات المختبرة كانت بمعدل مئوي 22,2% عدم مطابقة مع المواصفة القياسية العراقية للحدود الميكروبيولوجية في الغذاء، و55 % عدم مطابقة في التقييم الحسي. **المناقشة:** نسبة عالية من الأغذية المجمدة فشلت في كل من الفحص الميكروبي والحسي، وهذا يشير إلى عدم وجود تطبيق ممارسات التعامل الامن مع الأغذية التي ينبغي اتباعها من قبل متاجر المواد الغذائية. **الاستنتاج:** العديد من المنتوجات الغذائية المجمدة المعروضة في متاجر المواد الغذائية في مدينة بغداد تخزن بغياب ممارسات النظافة الجيدة ومعايير السلامة الغذائية الضرورية في عملية تداول الأغذية.

الكلمات المفتاحية: سلامة الغذاء، محلات التجزئة, الخصائص الميكروبية والحسية.

1. INTRODUCTION:

Freezing is one of the most common types of food preservation. Not only does freezing reduce food deterioration and spoilage, but converting the water into ice leads to stopping the growth of more than 99% of the types of bacteria contaminating food and slowing down many chemical reactions that may occur by enzymes found in foodstuffs. The shelf life of a food item can reach more than 12 months if it is frozen and stored at -18 degrees Celsius (Alsailawi *et al.,* 2020).

Experience, competence, efficiency, and innovation are keywords that apply to the entire food service industry, restaurants, large households, wholesalers, and manufacturers/suppliers. In this context, Deep-frozen and prepared foods must be seen (Deep Frozen Agency, 2008). There is constantly an exciting development in deep-frozen foods, which in modern restaurant kitchens and large households have become indispensable for home and professional food warehouses (Al-Jeddawi & Dawson, 2022).

Product development within the industry has led to a wide range in all imaginable processing grades, easily portioned, loosely frozen raw materials, prepared foods, and dishes ready to be heated and served (Fadi Aramouni & Kathrin Deschenes, 2016). Meat, fish, chicken, vegetables, and pancakes are examples of large deep-freeze groups used today in restaurants and large households (Jamila Shuara & Abigail Dairo, 2022).

The real breakthrough for what we know today as modern deep-freezing technology took place in the USA in 1920. The man behind the work was Clarence Birdseye, an adventurer and explorer who came to Labrador in Canada, where he lived near the Eskimos and studied the frozen fish they had caught. He noted that the frozen fish retained both its texture and flavor remarkably well (Jesse Rhodes, 2012).

Many reasons encourage people to eat frozen foods and buy them from food stores constantly (Alkhafaji M., 2020), including the fact that frozen food allows for more comfort and convenience (Sara Daniels *et al.,* 2015). Frozen foods are fresh, fast, and delicious. These are the most prominent characteristics of frozen food products, and they also me*et al*l our needs for preparing various types of favorite meals (Dariusz Góral *et al*., 2016). An added advantage of frozen foods is that we can buy them in bulk, easily store them in the freezer, and use them when needed. In addition, frozen foods are often less expensive than similar fresh foods, providing us with the same nutritional value (Alkhafaji, M. 2020).

Freezing foods, especially vegetables, allows the preservation of the vitamins stored in them with the same efficiency and effectiveness as when they were harvested (Alsoufi M. *et al*., 2022). This means that important vitamins and nutrients don't lose their value during storage and transportation. Also, frozen vegetables are considered more reliable in terms of nutritional value compared with fresh foods. (Linshan Li, 2017). For example, frozen fish is often fresher than non-frozen fish. Fresh fish may take a week to reach stores, in which case it requires additional preservatives, and it does not always retain its original nutritional value (Kaale LD *et al*., 2014).

When frozen food products are extracted from the freezer or left at room temperature in the food stores of Baghdad city, bacteria multiply again quickly at the danger zone temperature (40° - 140°). Therefore, defrosting must be viewed as a race between the consumer and the bacteria to complete the defrosting process and obtain the food in a form that can be consumed or cooked before bacteria multiply in more than permissible numbers. Food experts calculate victory in favor of bacteria if the food remains for two hours or more than two hours in the danger zone temperature. Thus, to protect consumers' health from the mentioned danger, this research was performed to check the food safety of frozen food products offered in local stores in Baghdad city (Kennedy, C. J. 2000)

Many frozen food products in the local market suffered from deterioration, which occurred during transportation or storage in the food stores in Baghdad. In this study, some frozen food products offered in local food stores in Bagdad City are selected to investigate their quality characteristics and what happened to them during the storage period in the freezers. Both sensorial and microbial characteristics are studied to verify their quality which is an important issue to the final consumer.

2. MATERIALS AND METHODS:

2.1. Materials:

Frozen food product samples offered in food stores in different places in Baghdad city are collected to test their quality characteristics at the laboratory of Microbiology-Market Research and Consumer Protection Center/the University of Baghdad.

Equipment:

- Freezer from the Microbiology Laboratory of the Market Research and Consumer Protection Center at the University of Baghdad to store the samples until the day of testing.
- Incubator at 37 °C for microbiological culture

Reagents and culture media:

- Agar Plate Count (APC) is the total bacterial count.
- Selenite F. Broth for Salmonella enrichment
- Salmonella-Shigella Agar (SSA) for Salmonella isolation
- Mannitol Salt Agar for detection of Staphylococcus aureus
- McConkey Agar for detection of E. coli

2.2. Methods:

2.2.1. Collection of samples

Different frozen food products were collected randomly from freezers of food stores in Baghdad city during the period April 2023 to May 2023, they were saved carefully and frozen at their optimum temperatures to the testing day. Testing of selected samples was done following the Iraqi standard of microbial limits in food No. 5/2270, 2015 (CSQC, 2015). Twenty samples were drawn from freezers of food stores in different places in Baghdad city, divided into five samples of breast chicken, five samples of beef sausage, five samples of chicken nuggets, and five samples of Mosel kuba, then kept in the freezer of the laboratory of Microbiology-Market Research and Consumer Protection Center/the University of Baghdad to the testing day.

2.2.2. Pre-evaluation of samples

Sensorial assessment of the collected samples was done on the day of testing at the laboratory of Microbiology-Market Research and Consumer Protection Center (MRCPC)/University of Baghdad by using methods for determining quality (Albielati S, 1988).

2.2.3. Microbial Analysis

Different studies worldwide ensured chicken meat contamination. (Rortana *et al*. 2021) reported the prevalence of *Salmonella spp*. and *S. aureus* in chicken meat in Cambodia at 40.4% and 46.2%, respectively. A study by (Mashak *et al*. 2018) revealed that 16.25% of chicken meat from Alborz, Iran, was positive for *E. coli*. Other studies also stated that several chicken meat samples from local markets in Indonesia presented microbial contamination, which included *S. aureus* (6.7%) and *Salmonella spp*. (85%), and *E. coli* (90.03%) (Karisma *et al.* 2021). The contamination of poultry products, including raw broiler meat, by pathogenic microorganisms, especially bacteria, has become one of the most challenging problems in the food industry worldwide (Pesewu *et al.* 2018).

A set of microbial tests was done on all collected samples at the Laboratory of Microbiology in the MRCPC by using analysis techniques and methods of the (American Public Health Association, 1998., Association of Official Analytical Chemists). The set of microbial tests included detecting microorganisms that were probably found in food samples collected during bad storage. Iraqi standards for microbial limits in food no. 5/2270 has been used to do that. Analysis techniques were used to detect the total account number of bacteria using Agar Plate Count (APC), *salmonella ssp., staphylococcus aureus, and E. Coli*. These microorganisms are the most common deterioration and spoilage of collected samples in this research.

- Agar Plate Count (APC): The method used to detect the number of bacterial colonies in the tested sample by taking a sterile pipette of 1 ml of diluted sample and putting it in three sterilized Petri dishes that contain plate count agar at 45 °C, the dishes moved in all directions to ensure that the sample has spread in the dish, then it left to solidify. The Petri dishes were inverted and incubated at 37 °C for 24 hours. After the mentioned time, the developing colonies in the dished calculated and compared with the Iraqi standard.
- Detection of Salmonella: to detect salmonella bacteria in the collected sample, 1 ml of the sample was added to 9 ml of Selenite F. Broth (prepared by dissolving 19 grams of Selenite F. Broth A and 4 grams of Selenite F. Broth B into distilled water completed the volume to 1 liter). The content was incubated at 37 °C for 24 hours. 1 ml of the diluted sample was struck into Petri dishes containing Salmonella-Shigella Agar (S.S.A) and incubated at 37 °C for 24 hours. *Salmonella* was tested using biochemical tests (Triple sugar iron agar, Lysine decarboxylase, Simmons citrate).
- Detection of Staphylococcus aureus: 1 ml of diluted sample was put into Petri dishes containing Mannitol Salt Agar and spread well in the dishes. After that, the dishes were incubated at 35 °C for 48 hours. To check and record results in the plates, colonies should be gray to black with a light-colored halo.
- Detection of *E. coli*: to detect *E. coli* bacteria in collected samples, McConkey Agar was poured into Petri dishes and left to solidify, 1 ml of diluted sample was put into the media and spread well in the dish, then another layer of media was poured into the dishes to provide non-aerobic condition. Dishes were incubated at 37 °C for 24 hours, and colonies were calculated to estimate the number of E. coli bacteria.

2.2.4. Statistical analysis

Statistical significance was assessed by using least significant differences – LSD (T-test) P – value < 0.05 was considered significance. Arithmetic mean and percentage are used in this research to analyze the results that were obtained.

3. RESULTS AND DISCUSSION:

3.1. Results

3.1.1. Sensorial assessment

The sensorial assessment was done after thawing the samples at room temperature. Depending on the researcher's practices and experience, the assessment included color, odor, the state of packaging, and the expiry date; the findings are illustrated in Table 1.

Results of the sensorial assessment showed that 11/20 of the selected samples failed at least one of the sensorial tests, as demonstrated in Table 1.

3.1.2. Microbial assessment

3.1.2.1. Total Count Bacteria (APC)

Application of safe food handling and good personal practices in food stores are essential to guarantee that food products served to the consumer are of good quality, safe, and not harmful to his health. Microbial tests are done on the selected samples as follows (APHA, 1998; AOAC, 2015; Ranjan, 2010). Results of the microbial test illustrated in Table 2 show that APC in breast chicken samples recorded different values. In contrast, samples B1, B2, B3, and B5 recorded good quality, while B4 exceeded upper permissible microbial limits in the food according to the Iraqi Standard No. 5/2270, 2006. Results of APC in beef sausage were within permissible limits for samples S2, S4, and S5, while out of the permissible range for S1 and S3. For Mosel Kuba samples, APC was good quality for all samples. As

a final result, only 3/20 samples (15%) failed the APC test, Table 2.

3.1.2.2. Detection of Salmonella

Results of microbial detection of *Salmonella ssp.* in all tested samples recorded Nils, which are confirmed with permissible microbial limits in food in accordance to the Iraqi Standard No. 5/2270, 2006, Table 3. The findings in this research are safe compared to previous studies done (YASSIN & EL-GAMMAL, 2016), detecting 18% of selected samples are contaminated by *Salmonella ssp.*

3.1.2.3. Detection of E. Coli

Results of *E coli* in the tested samples which required the test demonstrated that chicken nugget samples showed different values, whereas samples N2, N3, and N5 failed in the test, while N1 and N4 are confirmed with zero cfu/g according to Iraqi Standard No. 5/2270, 2006. Results of *E. coli* in Mosel kuba samples also showed different values. Samples M1, M2, M3, and M4 exceeded permissible limits, while Sample M5 was confirmed with the standard. As a final result, 7/20 samples (35%) failed in the *E coli* test, Table 4. The findings in this research are approximately 35%, which is higher than previous studies done by (YASSIN & EL-GAMMAL, 2016), detecting 18% of selected samples are contaminated by *E. Coli.*

3.1.2.4. Detection of Staphylococcus aureus

The detection of *Staphylococcus aureus* in collected samples of beef sausage showed different values. It exceeded the upper permissible microbial limits in food for all tested samples following the Iraqi Standard No. 5/2270, 2006. In the case of chicken nuggets, results showed exceeded upper permissible microbial limits for samples N1, N2, and N3, while confirmed with the standard for samples N4 and N5. Collected samples of mosel kuba demonstrated failure in the *Staphylococcus aureus* test in all samples to exceed permissible limits. As a final result, 10/20 samples (50%) failed in the *Staphylococcus aureus* test, Table 5. The findings in this research are higher than those in previous studies done (YASSIN & EL-GAMMAL, 2016), detecting 20% of selected samples are contaminated by *Staphylococcus aureus.*

3.2. Discussions

The results obtained for the quality characteristics of most selected samples showed devations from approved standards. These results given in both of sensorial and microbial analysis, reflected in first hand non-conformity with the optimum tempreture of frozen stored food products, and in second hand the absence of the application of good hygiene practices and food safety standards that are essential for food handling in food stores. It is very important and essential that food control authority in Iraq should be more strict in applying the laws and regulations in force regarding food safety and safe food handling.

4. CONCLUSIONS:

Frozen food products offered in Baghdad food stores suffered from the absence of application of food safety and hygiene practices in food handling that food store administrations should take. Many frozen food products are put at room temperature for a long time before being frozen in their suitable places in the freezers under -18 °C. Inspection authorities should take their role in monitoring food stores and registration deviations from food regulation and their instructions, and impose penalties and fines in cases required. Also, the Directorate of Sanitarily Monitoring/Iraqi Ministry of Health must be stricter in applying food safety standards in food handling following applicable regulations in force to preserve the public health of the consumer and ensure the consumption of safe foods. It was concluded from the study that frozen food products offered in the local market pose a high risk to public health, so strict hygienic measures should be taken during processing and handling to prevent cross-contamination. Based on the results of the research, it is recommended that studies be conducted on monitoring other food products offered in food stores in the local market and to demonstrate their compliance with the applicable food laws and legislations to preserve consumer health and prevent foodborne illness risks.

5. DECLARATIONS

5.1. Limitations

The study is limited to the sample size and the methods applied during the study.

5.2. Funding source

The author funded this research.

5.3. Competing Interests

No conflict of interest exists in this publication.

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Table 1. *Sensorial assessment of collected samples.*

No.	Samples	Symbol	Color	Odor	State of packaging	Expiry date
1	Breast chicken	B1	Dark	Normal	Good	10/12/2023
2	Breast chicken	B2	Dark	Normal	Good	22/12/2023
3	Breast chicken	B3	Dark	Normal	Damaged	07/08/2023
4	Breast chicken	B4	Dark	Normal	Good	08/11/2023
5	Breast chicken	B5	Dark	Normal	Damaged	15/09/2023
6	Beef sausage	S1	Normal	Normal	Good	07/01/2024
7	Beef sausage	S2	Normal	Normal	Good	15/01/2024
8	Beef sausage	S3	Normal	Normal	Good	18/01/2024
9	Beef sausage	S4	Normal	Normal	Damaged	10/10/2023
10	Beef sausage	S5	Normal	Normal	Damaged	09/08/2023
11	Chicken nuggets	N1	Normal	Normal	Damaged	10/08/2023
12	Chicken nuggets	N2	Normal	Normal	Good	20/12/2023
13	Chicken nuggets	N3	Normal	Normal	Good	11/11/2023
14	Chicken nuggets	N4	Normal	Normal	Damaged	22/6/2023
15	Chicken nuggets	N5	Normal	Normal	Good	27/10/2023
16	Mosel kuba	M1	Normal	Normal	Good	12/08/2023
17	Mosel kuba	M2	Normal	Normal	Good	25/10/2023
18	Mosel kuba	M3	Normal	Normal	Damaged	12/09/2023
19	Mosel kuba	M4	Normal	Normal	Good	10/10/2023
20	Mosel kuba	M5	Normal	Normal	Damaged	17/07/2023

Table 2. Total Count Bacteria (APC) *in Tested Samples*

No.	Samples	Symbol	Total Plate Count	Permissible limits
1	Breast chicken	B1	18×10^5	1×10^6 to 1×10^7
2	Breast chicken	B2	5×10^5	1×10^6 to 1×10^7
3	Breast chicken	B3	4×10^6	1×10^6 to 1×10^7
4	Breast chicken	B4	3×10^7	1×10^6 to 1×10^7
5	Breast chicken	B5	7×10^4	1×10^6 to 1×10^7
6	Beef sausage	S1	24×10^6	1×10^6 to 1×10^7
7	Beef sausage	S2	7×10^6	1×10^6 to 1×10^7
8	Beef sausage	S3	3×10^7	1×10^6 to 1×10^7
9	Beef sausage	S4	5×10^5	1×10^6 to 1×10^7
10	Beef sausage	S5	16×10^4	1×10^6 to 1×10^7
11	Chicken nuggets	N1	Not required	Not required
12	Chicken nuggets	N2	Not required	Not required
13	Chicken nuggets	N3	Not required	Not required
14	Chicken nuggets	N4	Not required	Not required
15	Chicken nuggets	N5	Not required	Not required
16	Mosel kuba	M1	2×10^5	1×10^6 to 1×10^7
17	Mosel kuba	M2	8×10^5	1×10^6 to 1×10^7
18	Mosel kuba	M3	4×10^6	1×10^6 to 1×10^7
19	Mosel kuba	M4	8×10^6	1×10^6 to 1×10^7
20	Mosel kuba	M5	12×10^4	1×10^6 to 1×10^7

Table 3. *Detection of Salmonella in Tested Samples*

No.	Samples	Symbol	*Salmonella*	Permissible limits
1	Breast chicken	B1	Nils	Zero
2	Breast chicken	B2	Nils	Zero
3	Breast chicken	B3	Nils	Zero
4	Breast chicken	B4	Nils	Zero
5	Breast chicken	B5	Nils	Zero
6	Beef sausage	S1	Nils	Zero
7	Beef sausage	S2	Nils	Zero
8	Beef sausage	S3	Nils	Zero
9	Beef sausage	S4	Nils	Zero
10	Beef sausage	S5	Nils	Zero
11	Chicken nuggets	N1	Nils	Zero
12	Chicken nuggets	N2	Nils	Zero
13	Chicken nuggets	N3	Nils	Zero
14	Chicken nuggets	N4	Nils	Zero
15	Chicken nuggets	N5	Nils	Zero
16	Mosel kuba	M1	Nils	Zero
17	Mosel kuba	M2	Nils	Zero
18	Mosel kuba	M3	Nils	Zero
19	Mosel kuba	M4	Nils	Zero
20	Mosel kuba	M5	Nils	Zero

Table 4. *Detection of E coli in Tested Samples*

No.	Samples	Symbol	*E. coli*	Permissible limits
1	Breast chicken	B1	Not required	-
2	Breast chicken	B2	Not required	-
3	Breast chicken	B3	Not required	-
4	Breast chicken	B4	Not required	-
5	Breast chicken	B5	Not required	-
6	Beef sausage	S1	Not required	-
7	Beef sausage	S2	Not required	-
8	Beef sausage	S3	Not required	-
9	Beef sausage	S4	Not required	-
10	Beef sausage	S5	Not required	-
11	Chicken nuggets	N1	Nils	Zero
12	Chicken nuggets	N2	3×10^4	Zero
13	Chicken nuggets	N3	2×10^6	Zero
14	Chicken nuggets	N4	Nils	Zero
15	Chicken nuggets	N5	6×10^2	Zero
16	Mosel kuba	M1	4×10^4	Zero
17	Mosel kuba	M2	2×10^3	Zero
18	Mosel kuba	M3	5×10^2	Zero
19	Mosel kuba	M4	1×10^4	Zero
20	Mosel kuba	M5	Nils	Zero

Table 5. *Detection of Staphylococcus aureus in tested Samples*

No.	Samples	Symbol	*Staphylococcus aureus*	Permissible limits
1	Breast chicken	B1	Not required	-
2	Breast chicken	B2	Not required	-
3	Breast chicken	B3	Not required	-
4	Breast chicken	B4	Not required	-
5	Breast chicken	B5	Not required	-
6	Beef sausage	S1	21×10^6	1×10^2 to 1×10^3
7	Beef sausage	S2	8×10^5	1×10^2 to 1×10^3
8	Beef sausage	S3	4×10^4	1×10^2 to 1×10^3
9	Beef sausage	S4	2×10^2	1×10^2 to 1×10^3
10	Beef sausage	S5	5×10^2	1×10^2 to 1×10^3
11	Chicken nuggets	N1	8×10^4	1×10^3 to 1×10^4
12	Chicken nuggets	N2	1×10^4	1×10^3 to 1×10^4
13	Chicken nuggets	N3	4×10^3	1×10^3 to 1×10^4
14	Chicken nuggets	N4	2×10^2	1×10^3 to 1×10^4
15	Chicken nuggets	N5	4×10^5	1×10^3 to 1×10^4
16	Mosel kuba	M1	12×10^6	5×10^2 to 1×10^3
17	Mosel kuba	M2	3×10^6	5×10^2 to 1×10^3
18	Mosel kuba	M3	2×10^4	5×10^2 to 1×10^3
19	Mosel kuba	M4	5×10^3	5×10^2 to 1×10^3
20	Mosel kuba	M5	3×10^4	5×10^2 to 1×10^3