

Detection of Starch Adulteration in Local Soft Cheeses and Commercial Marketer for International Companies Marketing in Kirkuk City Iraq

Muna Hashim Taha

Department of Public Health, College of Veterinary Medicine, University of Kirkuk, Iraq

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Annotation: This study aims to investigate the prevalence of starch adulteration in local soft cheeses (traditionally known as "Arab Cheese") and commercial brands for international companies like Kerry, Anchor, Puck, and others available in the central market within Kirkuk city, north of Iraq. Despite the nutritional importance of dairy, economic fraud through the addition of thickeners is a growing concern. This study included 34 samples, divided by 17 samples from different commercial sources in market and 17 samples local soft cheeses (traditionally known as "Arab Cheese") Using a qualitative chemical approach centered on the Iodine-Starch reaction and quantitative Analysis by use (Spectrophotometry method), this research screens samples collected from diverse geographical areas in Kirkuk city November2024 to April 2025. Based on recent regional data, The results showed high starch detection rates of up to 35.3% samples contain starch in local soft cheese by using direct chemical examination and 35.3% from samples are samples showed no color change this detecting to absence of starch and 29.4% are slight color change this detecting to no present small amount of starch, In contras cheese commercially marketed where 52.9%of samples positive for starch, 29.4% samples contained trace amounts or no starch and 17.6% have medium of starch. This study provides critical

insights into food safety and consumer protection
in Northern Iraq.

Introduction

While starch is a natural food component, its undeclared addition to dairy products has several negative health implications according to The International Journal of Food Science (2024), Risk for Diabetics: Dairy products are generally considered low-glycemic foods. However, adulteration with starch increases the Glycemic Index (GI) of the cheese or yogurt. This can lead to unexpected blood sugar spikes in diabetic patients who rely on accurate food labeling . Digestive Issues, The use of raw or poorly processed industrial starch as an adulterant can cause gastrointestinal distress, bloating, and diarrhea in sensitive individuals. Nutritional Deception: Adulteration reduces the Protein to Carbohydrate ratio. Consumers, especially children and the elderly who need high protein intake, suffer from "hidden malnutrition" because they are consuming empty calories instead of essential milk proteins, DPI Agriculture, (2025). Allergenic Risks: Sometimes, the source of starch (such as wheat starch) contains gluten, which poses a severe risk to individuals with Celiac disease or gluten intolerance. Local Soft cheese is a staple in the Kirkuk diet, often sourced from small-scale local producers in areas like (Shorja, Al-Qala'a , Al-Wasity , Al-Hawija , Baghdad Road, RasDomez).and other areas in Kirkuk city and commercially available cheeses from different brands in Kirkuk markets; however, its quality is often compromised by "Economic Adulteration." Producers may add starch to increase the yield and viscosity of cheese made from diluted or low-quality milk. While starch is not inherently toxic, its undeclared presence constitutes food fraud, reduces the protein value per gram, and poses health risks to diabetic individuals who must monitor daily carbohydrate intake (Kumar & Dash, 2024).

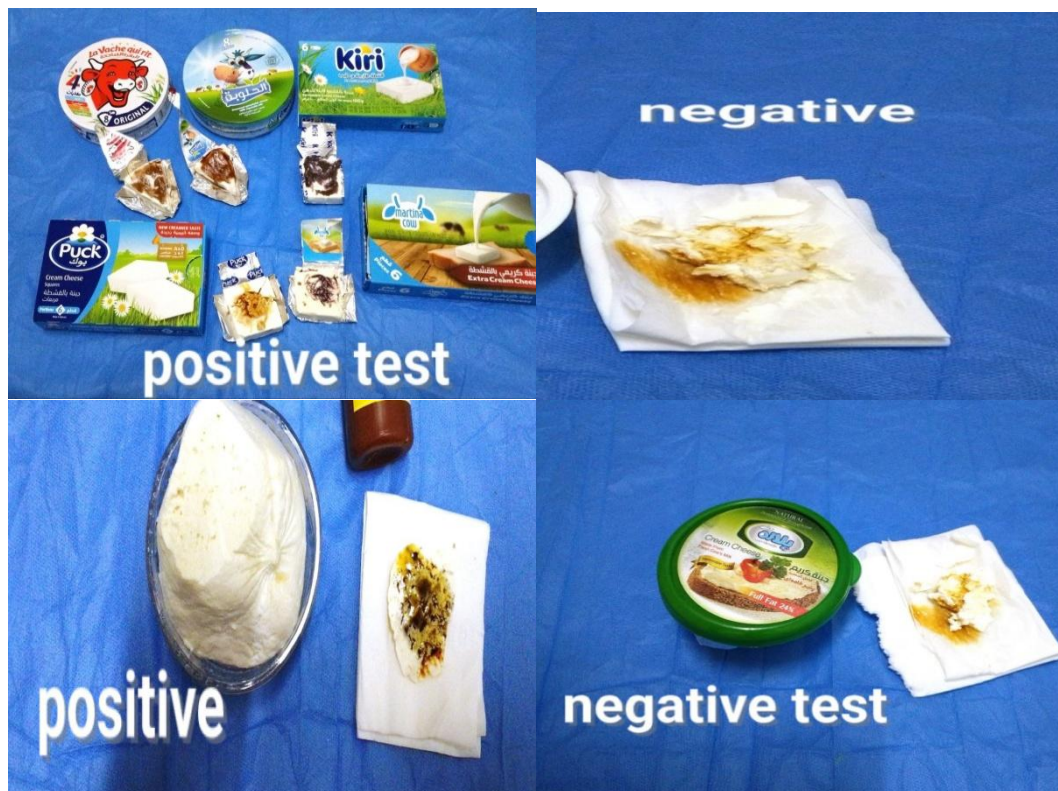
Methods and Materials

This study was conducted in Kirkuk city, during November 2024 - April 2025, to assess the, Detection of starch adulteration in local soft cheeses and commercial marketer for international companies marketing in Kirkuk city. Kirkuk city is located in north of Iraq, with population of 2,034,627 according to last census conducted by Iraqi authorities in 2024. A total of 34 samples were collected from Traditional Markets from different areas of Kirkuk (Shorja, Al-Qala'a , Al-Wasity, Al-Hawija, Baghdad Road, RasDomez).the samples were divided into 17 samples from local soft cheeses and 17 samples from commercial marketer for international companies marketing in Kirkuk city. Use two methods in this study.

1-Qualitative Test (Rapid Screening Method)

Iodine test:-simple and widely chemical test that used to detect the presence of starch, when iodine reagent contact with starch it forms a complex that produces a distinct blue-black color. Material use:

- 1- Iodine reagent 1% (iodine reagent was prepared by adding 0.5 g from I₂ and 1g KI, then adjusted to 100 mL with ultra-high-purity water).
- 2- Sample (Different types of cheese).
- 3- petri dish
- 4- Dropper



Procedure

Add a piece of cheese in petri dish and add 3 to 4 drops of iodine reagent 1% on the cheese if the color becomes blue-black color this indicate son percent the starch. if the color does not change it means the starch not present in this cheese.

2-Quantitative Analysis (Spectrophotometry method).

This method was used for examination and quantifying moderate to high levels of adulteration, depends on the absorbance of the blue- black colored complex formed from reaction that occur between starch and iodine reagent.

Materials use in this test

- 1- Iodine reagent 1%.
- 2- Sample (Different types of cheese).
- 3- Spectrophotometer
- 4- Cuvettes
- 5- Pipettes
- 6- Glassware
- 7- Filter paper
- 8- Blank (distilled water and iodine reagent).

Procedure

Preparation the sample (take10 grams from cheese chopping and grinding then dissolved in distilled water 10-20 ml for homogenize) after this steps filter the solution by filter paper to separate the solution from solid parts ,after than add the few drops from iodine reagent 1% (iodine reagent was prepared by adding 0.5 g from I₂ and 1g KI, then adjusted to 100 mL with ultra-high-purity water)if the color change to blue – black this indicates the presence of starch qualitative , Transfer a sufficient quantity of the solution to Cuvette for measurement the sample

in spectrophotometer in wavelength approximately 600 nm , after the spectrophotometer is zeroed by using the blank distilled water and iodine reagent .



Chart for results recording local cheese test

Sample no.	Absorbance reading	Present starch	Note
Sample1	0.02	Low No significant	Very low absorption
Sample2	0.07	Low	Slight present
Sample3	0.3	Moderate	Possible starch presence
Sample4	0.3	Moderate	Possible starch presence
Sample5	0.10	low	Slight present
Sample6	0.6	High	High starch presence
Sample7	0.6	High	High starch presence
Sample8	0.8	Very high	Strong evidence of starch
Sample9	0.7	high	High starch presence
Sample10	0.0	No starch	No absorption
Sample11	0.001	No starch	No absorption
Sample12	0.02	Low No significant	Very low absorption
Sample14	0.9	Very high	Strong evidence of starch
Sample15	0.5	High	High starch presence
Sample16	0.3	Moderate	Possible starch presence
Sample17	0.00	No starch	No absorption

Chart for results recording commercial marketer for international companies marketing

Sample no.	Absorbance reading	Present starch	Note
Sample1	0.5	High	High starch presence
Sample2	0.9	Very high	Strong evidence of starch
Sample3	0.3	Moderate	Possible starch

			presence
Sample4	0.607	High	High starch presence
Sample5	0.10	low	Slight present
Sample6	0.6	High	High starch presence
Sample7	0.6	High	High starch presence
Sample8	0.8	Very high	Strong evidence of starch
Sample9	0.7	high	High starch presence
Sample10	0.004	No starch	No absorption
Sample11	0.001	No starch	No absorption
Sample12	0.02	Low no significant	Very low absorption
Sample14	0.07	Low	Slight present
Sample15	0.53	High	High starch presence
Sample16	0.31	Moderate	Possible starch presence
Sample17	0.9	Very high	Strong evidence of starch

Results

A total of 34 samples were analyzed of cheese that underwent two The types of analysis, qualitative analysis by use iodine reagent direct on the piece of cheese when the color change to blue- black this indicate on present starch qualitative, in this method the 17 types of local cheese regarding the starch detection tests in the locally manufactured cheese, the results were as follows: 6 types of cheese exhibited a dark color change, indicating the presence of a high concentration of starch, 6 types of cheese were completely free of starch, showing no color change, 5 types of cheese showed a slight color change, indicating trace or minor amounts of starch. This method named qualitative Test (Rapid Screening Method). The other17samples ,consisting of imported cheese were analyzed by using device in laboratory spectrophotometer. The analysis was conducted using a spectrophotometer at a wavelength of 620 nm. The results showed that 9 types of cheese contained a large amount of starch, while 3 types had a medium starch content. Additionally, 2 types of imported cheese showed no absorption, indicating that they do not contain any starch, and 2 other types had low absorption, meaning they contain a very small amount of starch.

Literature Review

The recent of current study has revealed that the importance of Starch adulteration in dairy products, particularly in cheeses locally made cheeses and imported cheeses. The adulteration of dairy products with starch, especially in the cheese industry, due to cause health problems to the diabetic patients and people who follow diets. This adulteration represents a critical worldwide problem that is often overlooked in regions like the Middle East like Iraq. New research highlights that this practice is effects on public health and Economically, using starch in cheese is profitable because it is cheap and non-toxic substance. One of the significant health risks posed by starch is the elevation of blood glucose levels; specifically, when present in large quantities, it can lead to sudden and sharp spikes in blood sugar. Research by Zhang et al. (2023) highlights that the addition of starch can significantly increase the glycemic index of dairy products, posing risks to diabetic patients who depend on accurate nutritional information. The

presence of starch leads to unexpected spikes in blood glucose, as noted by Smith et al. (2022), further complicating dietary management. Starch not only alters the metabolic properties of cheese but also dilutes its nutritional value. As demonstrated in a study by Khan et al. (2023), the Protein-to-Carbohydrate ratio decreases significantly in adulterated products, resulting in a form of "hidden malnutrition," particularly detrimental to vulnerable populations such as children and the elderly. Methods use for starch detection The qualitative method(direct chemical examination by use iodine reagent remains a reliable approach for identifying starch in dairy products. Studies by Lee et al. (2024), illustrate its effectiveness in revealing the presence of starch, demonstrating that colorimetric changes correlate well with starch concentration. There are modern and innovative methods for the quantitative measurement of starch levels , utilizing advanced devices that offer higher precision in determining the exact concentration of starch within sample ,study Research by Yadav (2024), demonstrates how these methods can enhance the accuracy of adulteration detection, calling for their integration into routine quality control. the adulteration is effect on the market activity and trade, As explored by Noor et al. (2022), consumer trust in dairy products diminishes when adulteration is prevalent, leading to potential economic downturns for honest producers. Based on this study and the high prevalence of starch adulteration revealed by the results, which significantly impacts public health; it is essential to conduct long-term longitudinal studies. Such research is necessary to demonstrate the future health implications resulting from the regular consumption of adulterated dairy products or those containing high concentrations of starch. Wong et al. (2023) , call for longitudinal studies to assess the impact of regular consumption of such products on public health over time.

Conclusion

The study reveals a significant prevalence of starch adulteration in both local soft cheeses and commercially marketed products in Kirkuk city/Iraq. The percentage of adulteration obtained qualitatively from direct chemical analysis of iodine test and quantitatively from the spectrophotometer in the laboratory was presented. The adulteration rates of starch found in imported cheese was 52.9%, while in locally produced cheese it was 35.3%. These results highlight a danger to food safety and consumer health, especially for patients suffering from diabetes and those with individuals with specific dietary sensitivities to starch, who follow dietary restrictions. It has become essential to find a solution to this problem to protect consumers and maintain the nutritional value of the products available in the markets of Kirkuk/Iraq.

Recommendations

- 1- To protect consumers and maintain product quality, there should be laboratory analyses to detect starch.
- 2- Conduct awareness and educational campaigns for the community (consumers, producers, and traders importing products with low nutritional value).
- 3- Encourage local authorities to implement strict regulations on local producers and traders.
- 4- Promote long-term studies by researchers on individuals who are more at risk to demonstrate the future effects of starch on them.
- 5- Encourage collaboration with research institutions to enhance food safety and discover new methods for detecting fraud.

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