

# UNWANTED TOXINS IN CHICKEN NUGGETS: DETECTION AND ANALYSIS OF HARMFUL COMPOUNDS

**National Science Fair Research Paper**

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# TABLE OF CONTENTS

Contents

<b>TABLE OF CONTENTS</b> .....	2
<b>SUMMARY:</b> .....	3
<b>CASE STUDY:</b> .....	4
<b>INTRODUCTION:</b> .....	5
<b>STATEMENT OF PROBLEM:</b> .....	6
<b>HYPOTHESIS:</b> .....	6
<b>SAMPLES COLLECTED:</b> .....	6
<b>MATERIALS:</b> .....	7
<b>PROCEDURE:</b> .....	8
<b>VARIABLES:</b> .....	9
<b>PHOTOS:</b> .....	10
<b>OBSERVATIONS &amp; INFERENCES:</b> .....	13
<b>INTERPRETATION:</b> .....	14
<b>RESULT:</b> .....	14
<b>DISCUSSION:</b> .....	15
<b>CONCLUSION:</b> .....	16
<b>FUTURE ENHANCEMENT:</b> .....	17
<b>ACKNOWLEDGEMENT:</b> .....	18
<b>BIBLIOGRAPHY:</b> .....	19

## SUMMARY:

This experiment compares **three types of chicken nuggets**: frozen store-bought nuggets, fast-food nuggets, and homemade nuggets. The purpose was to check which option is healthier. The samples were tested for **sodium level, oil freshness (rancidity), and presence of artificial food dyes**. The results showed that **frozen and fast-food nuggets had high sodium**, while **homemade nuggets had much lower sodium**. The **fast-food nuggets showed rancid or repeatedly used oil**, but the **homemade nuggets were prepared using fresh oil**. In the dye test, **artificial food colors were found in fast-food nuggets**, while **no dyes were detected in homemade samples**.

Overall, this experiment demonstrates that **homemade chicken nuggets are the healthier and safer choice**, because they use **fewer chemicals, fresh oil, and contain no artificial dyes**, unlike frozen and fast-food nuggets.

## CASE STUDY:

Studies from around the world show that chicken nuggets and other fried foods can contain hidden harmful substances. In Europe and the U.S., fast-food chicken was found to have **acrylamide**, a chemical formed during frying that may increase cancer risk over time. People who eat fried foods often also get too many **trans fats**, which can harm the heart. Preservatives like **nitrites** in processed nuggets can turn into chemicals called **nitrosamines** when fried, which may damage the stomach and liver. Some studies even found tiny chemicals from packaging, called **phthalates**, which can affect hormones.

In India, food authorities like **FSSAI** have found that street vendors often **reuse frying oil**, which produces harmful substances. Packaged and frozen nuggets can have **too much salt and preservatives**, which may increase the risk of **high blood pressure, heart problems, and kidney issues**, especially for children and young people in cities like Chennai, Mumbai, and Delhi. These examples show that store-bought and fast-food nuggets often have hidden risks, while **homemade nuggets are usually safer**.



# INTRODUCTION:

Chicken nuggets are one of the most popular fast-food items consumed worldwide, loved especially by children and young adults for their taste, convenience, and affordability. However, behind their crispy outer layer and soft meat, nuggets may carry hidden risks. During processing, deep frying, and storage, harmful substances such as **acrylamide, excess sodium, preservatives, and artificial dyes** can be formed or added. These compounds are not visible to the eye but can enter our bodies when we eat them.

Research has shown that regular consumption of nuggets with such toxins may lead to serious health problems like **obesity, high blood pressure, heart disease, and even cancer**. Despite their widespread popularity, there is very little consumer awareness about these harmful compounds. This project aims to detect and compare unwanted toxins in **fast-food, packaged, and homemade chicken nuggets**, to highlight the risks and promote safer food practices.

## STATEMENT OF PROBLEM:

Chicken nuggets are a popular fast-food item enjoyed by children and adults for their taste and convenience, but many fast-food and packaged nuggets contain hidden toxins and additives such as excess sodium, preservatives, acrylamide, and artificial dyes. These substances, formed during processing, frying, or storage, can pose serious health risks if consumed regularly, including heart disease, obesity, and cancer. Most consumers are unaware of these risks, so this project asks: Do fast-food and packaged chicken nuggets contain more harmful compounds than homemade nuggets, and how significant are the differences?

## HYPOTHESIS:

Fast-food and packaged chicken nuggets will contain **higher levels of sodium, rancid oil residues, and artificial dyes** compared to homemade chicken nuggets. Is it true ?

## SAMPLES COLLECTED:

Fast Food: <https://maps.app.goo.gl/UM82NRzvsCXa7APb7>

Frozen: <https://maps.app.goo.gl/BrxYg3ByJAArM57c7>

Homemade:

<https://maps.app.goo.gl/X34nQkLXcBHwnWMM8>

# MATERIALS:

- Store-bought packaged chicken nuggets
- Fast-food chain chicken nuggets
- Homemade chicken nuggets (fresh chicken, batter, fried once in fresh oil)
- Chemicals:
  - Silver nitrate ( $\text{AgNO}_3$ ),
  - Potassium Chromate ( $\text{K}_2\text{CrO}_4$ )
  - Potassium iodine
  - Sodium Thio sulphate
- Chromatography paper
- Ethanol
- Distilled water
- Beakers
- Pipettes
- test tubes

## PROCEDURE:

- Take the three nugget samples and crush each one to form a broth.
- Transfer each broth into separate test tubes and add distilled water. Mix well.
- From this mixture, take a small portion into another test tube and add **potassium chromate**.
- Slowly add **silver nitrate** using a pipette until the solution turns **reddish-brown** (this shows sodium level).
- Take a piece of **chromatography paper** and fold the bottom edge.
- Using a pipette, place a drop of the broth mixture onto the paper.
- Prepare a beaker with a **solvent** (ethanol + distilled water).
- Dip the chromatography paper in the solvent and observe if **different colour bands** appear (this shows artificial dyes).
- Take three clean test tubes and pour the broth mixture into each.
- Add **potassium iodide**, then slowly add **sodium thiosulfate** until a **blue colour** appears (endpoint for rancidity).

# **VARIABLES:**

## **INDEPENDENT:**

- Type of nugget.

## **DEPENDENT:**

- Sodium
- Preservatives
- Oil rancidity
- Dyes.

## **CONSTANT VARIABLE:**

- Equal sample size
- same testing method.

# PHOTOS:

## SAMPLES PHOTOS:



**FROZEN CHICKEN NUGGETS**

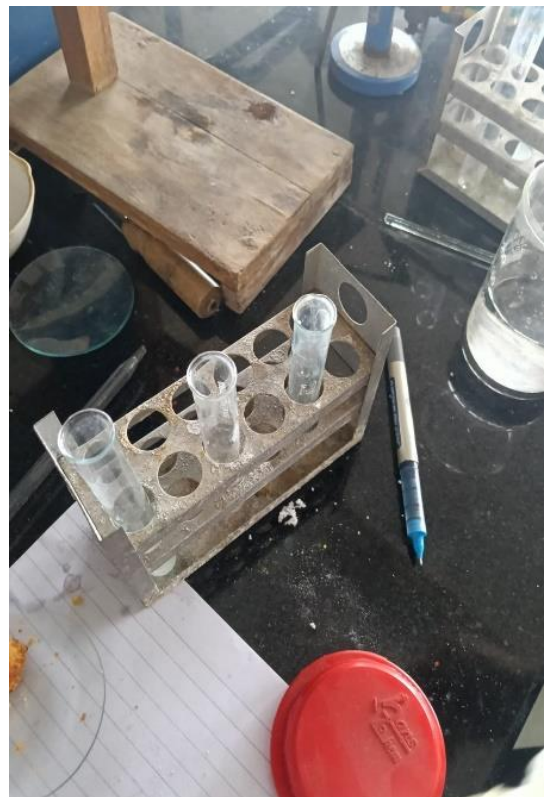


**FAST FOOD NUGGETS**

**HOME MADE NUGGETS**

## EXPERIMENT PHOTOS:







# OBSERVATIONS & INFERENCES:

<b>NUGGET TYPE</b>	<b>SODIUM (ml)</b>	<b>OIL RANCIDITY</b>	<b>FOOD DYES</b>
<b>PACKED FROZEN CHICKEN NUGGET</b>	✧ Turned into reddish-brown quickly of adding 5ml AgNO <sub>3</sub>	✧ Needed more sodium thiosulfate to reach blue endpoint. - oil is sightly rancid	✧ No artificial dye present
<b>FAST FOOD CHICKEN NUGGET</b>	✧ Reddish brown formed quickly of adding 2ml of AgNO <sub>3</sub>	✧ Needed a lot of sodium thiosulfate- oil more rancid	✧ Slight yellow/orange coloration in water after soaking
<b>HOME-MADE CHICKEN NUGGET</b>	✧ Reddish-brown formed slowly of adding 3ml AgNO <sub>3</sub>	✧ Needed very little sodium thiosulfate – oil was fresh	✧ No colour leaching into water; colour remains natural. No artificial food dyes detected – indicates use of natural ingredients(turmeric)

## INTERPRETATION:

From this experiment, we found that frozen chicken nuggets contain a high amount of sodium, while homemade nuggets have only a small amount. We also observed that the oil in homemade nuggets was fresh, but in fast-food nuggets the oil showed signs of rancidity.

In the food dye test, artificial colour was clearly present in fast-food nuggets, but not present in the frozen or homemade samples.

Therefore, we can conclude that **homemade chicken nuggets are the healthier and safer choice**, as they use **fresh oil**, have **less sodium**, and contain **no artificial dyes**—unlike frozen and fast-food nuggets.

## RESULT:

From the experiment, it was found that **frozen chicken nuggets had the highest sodium content**, while **homemade nuggets had the lowest**. The **fast-food nuggets showed signs of rancid or reused oil**, but the **homemade nuggets were prepared in fresh oil**. In the **food dye test, artificial coloring was present only in fast-food nuggets**, and not in the frozen or homemade samples. These results show that **homemade chicken nuggets are cleaner and healthier compared to frozen and fast-food nuggets**.

## DISCUSSION:

This project highlights the potential presence of **hidden toxins and additives** in chicken nuggets, such as excess salt, preservatives, rancid oil, and artificial dyes. By comparing fast-food, packaged, and homemade nuggets, it aims to raise awareness about the **possible health risks** of frequent consumption of processed nuggets. Even at this initial stage, the project provides a foundation for understanding how everyday foods can affect human health and encourages safer food choices, such as making nuggets at home or using healthier cooking methods. It also sets the stage for future experiments to **measure and analyze these harmful compounds more precisely**, helping students and consumers make informed decisions about the foods they eat.

## CONCLUSION:

This study helped us understand how the **quality of food can change based on how it is made and where it comes from**. The tests showed that frozen and fast-food nuggets often contain **extra sodium, added colors, and oil that is not always fresh**. On the other hand, homemade nuggets are prepared with **fewer additives, fresh ingredients, and cleaner oil**, which makes them a better choice for health. So, choosing **homemade food gives us more control over what we eat** and helps avoid unnecessary chemicals and unhealthy fats. This experiment shows the importance of being **aware of the ingredients used in packaged and restaurant foods** and encourages us to **prefer fresh, home-prepared meals whenever possible**.

Freezing itself is a preservative: The low temperatures of a freezer prevents the growth of bacteria and other microorganisms, so a separate chemical preservative is often unnecessary for shelf life.

## FUTURE ENHANCEMENT:

In the future, this experiment can be improved by testing **more brands** and a **larger number of samples** to get even more accurate results. We can also test other nutrients such as **fat content, protein quality, and moisture level** to understand the nutritional differences more clearly. Additionally, using digital instruments like **spectrophotometers or pH meters** could give more precise readings. This study can also be extended to compare **other fast-food items** to help people make healthier food choices.

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