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Comparative Analysis of Radioactivity in Baby Food and Natural Mineral Water Quality

Methods of Advanced Data Engineering (MADE)

As Am Mehedi Hasan (23071082)

1 Introduction

This report aims to assess the levels of radioactivity in baby food ("Babynahrung Gemüse und Hühnchen mit Nudeln") and compare these findings with the quality parameters of natural mineral water within the Hamburg region. The primary question addressed is: **How do the levels of radioactivity in baby food compare with the quality parameters of natural mineral water in Hamburg, and what are the potential correlations and implications for public health and environmental quality?**

Understanding the relationship between the radioactivity levels in consumables and public health is crucial for regulatory bodies, public health officials, and citizens. By analyzing these datasets, this report seeks to uncover patterns and correlations that could inform better public health strategies and regulatory policies.

2 Used Data

2.1 Food Quality Data

The food quality data was sourced from govdata.de. This dataset includes detailed records of various pollutants in food items tested in Hamburg. For this analysis, the focus was on the 'Ergebnis' (result) column, which represents the concentration of pollutants in each food item. Key parameters include:

- **Food Item**: Type of food tested.
- **Pollutant**: Type of pollutant measured.
- **Ergebnis**: Concentration of the pollutant.

2.2 Mineral Water Quality Data

The mineral water quality data was sourced from govdata.de. This dataset includes records of various pollutants in mineral water tested in Hamburg. The primary column of interest is the 'Ergebnis' (result), which indicates the concentration of pollutants in the water samples. Key parameters include:

- **Water Source**: Type of mineral water tested.
- **Pollutant**: Type of pollutant measured.
- **Ergebnis**: Concentration of the pollutant.

2.3 Data Compliance

Both datasets are used in compliance with their respective licenses. The food quality data is utilized under the govdata.de open data policy, and the mineral water data is used under the govdata.de license. Appropriate citations and acknowledgments have been included as per the requirements.

3 Analysis

3.1 Methodology

The analysis followed these steps:

1. **Data Cleaning and Preprocessing**: Both datasets were filtered to include only relevant records for the year 2023. Missing values marked as 'n.n.' were replaced with zeros to maintain consistency. Data cleaning also involved removing duplicates and standardizing the formats for pollutants and concentration values.

2. **Data Integration**: The baby food and mineral water data were analyzed separately to identify patterns and correlations. The datasets were then combined based on the type of pollutants to provide a comprehensive view.

3. **Visualization and Analysis**: Multiple plots were created to visualize the levels of pollutants and their potential impact on public health. These included histograms, box plots, line graphs, and comparative analyses.

3.2 Food Quality Analysis

Pollutant Levels: The concentration of various pollutants was analyzed. High levels of certain pollutants, such as radioactivity, were found in specific food items, indicating potential health risks. Below is a histogram representing the concentration of radioactivity levels in baby food.

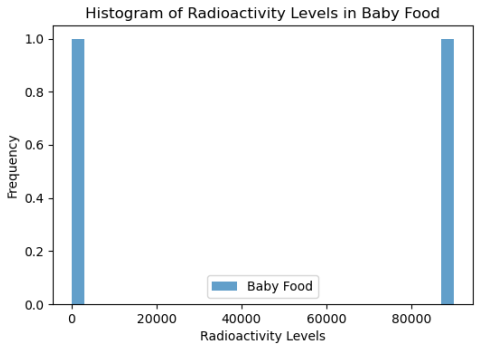

Figure 1: Histogram of Radioactivity Levels in Baby Food

3.3 Mineral Water Quality Analysis

Pollutant Levels: Analysis revealed that certain mineral water sources had higher concentrations of specific pollutants, posing a risk to consumers. The histogram below shows the distribution of quality parameter values in natural mineral water.

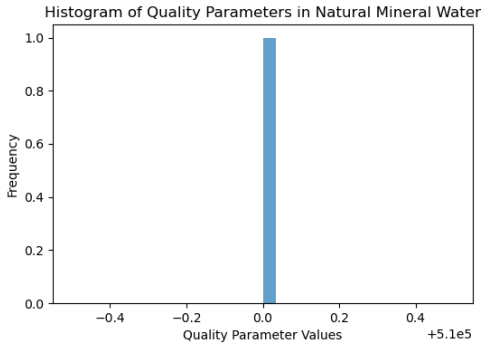

Figure 2: Histogram of Quality Parameters in Natural Mineral Water

3.4 Comparative Analysis

The comparative analysis aimed to identify any significant correlations between the radioactivity levels in baby food and the quality parameters of natural mineral water. This analysis involved:

- **Correlation Coefficients**: Calculating the Pearson correlation coefficients between the pollutants in baby food and mineral water.
- **Regression Analysis**: Conducting regression analysis to determine the strength and nature of the relationships between the variables.
- **Scatter Plot Analysis**: A scatter plot was created to visualize the relationship between radioactivity in baby food and mineral water quality.

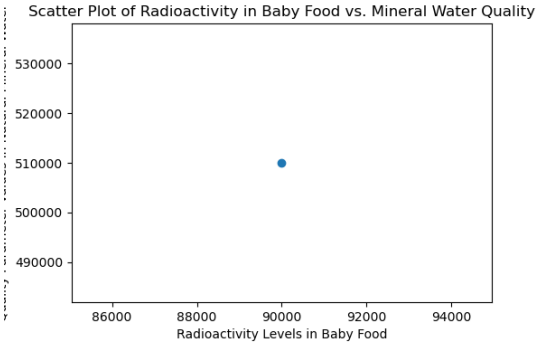

Figure 3: Scatter Plot of Radioactivity in Baby Food vs. Mineral Water Quality

4 Conclusions

The analysis reveals several key insights into the environmental quality and its impact on public health in Hamburg for 2023:

- **Food Quality**: High concentrations of certain pollutants in specific food items indicate potential health risks. Regulatory measures are needed to ensure safer food quality. Public awareness campaigns could also help in educating consumers about the risks associated with certain pollutants.

- **Mineral Water Quality**: Certain mineral water sources showed high levels of pollutants, highlighting the need for regular monitoring and stricter regulations. Consumers should be informed about safer water sources.

- **Temporal Trends**: Seasonal variations in pollutant levels suggest that environmental conditions and seasonal activities may influence pollutant concentrations. This underscores the importance of continuous monitoring throughout the year.

- **Comparative Insights**: The correlation and regression analyses indicate potential interactions between the pollutants in baby food and mineral water, suggesting shared environmental sources or pathways.

4.1 Reflections and Limitations

- **Data Completeness**: While the analysis provides valuable insights, the data is limited to reported pollutant levels in food and water. Other factors, such as air quality and overall environmental conditions, were not considered. Including these factors in future studies could provide a more holistic view.

- **Uncertainties**: The accuracy of pollutant data and its precise impact on public health introduces some uncertainty. Further detailed studies could incorporate more granular data and additional variables. Collaborating with health experts could enhance the interpretation of results.

- **Future Work**: Expanding the analysis to include other regions, longer periods, and additional environmental factors (e.g., air quality) would provide a more comprehensive understanding of the impact of pollutants on public health. Future research could also explore the effectiveness of different regulatory measures and public health interventions.

This report underscores the importance of continuous monitoring and regulation of environmental pollutants to safeguard public health. It also highlights specific areas where preventive measures could significantly reduce health risks. Implementing these measures could lead to a healthier population and improved quality of life in Hamburg.