Untitled

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```
library(readxl)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
file_path <- "fluidmilk.xlsx"
fluidmilk_data <- read_excel(file_path, sheet = "fluidmilk")
```

```
## New names:
## * `` -> `...2`
## * `` -> `...3`
## * `` -> `...4`
## * `` -> `...5`
## * `` -> `...6`
## * `` -> `...7`
## * `` -> `...8`
## * `` -> `...9`
## * `` -> `...10`
```

```
colnames(fluidmilk_data) <- c("Year", "Whole_Milk", "Reduced_Fat_2_%",
                              "Low_Fat_1_%", "Skim", "Flavored_Whole",
                              "Flavored_Other", "Buttermilk", "Eggnog", "Total_Sales")


fluidmilk_data <- fluidmilk_data %>%
  mutate(Year = as.numeric(Year)) %>%
  filter(!is.na(Year))
```

```
## Warning: There was 1 warning in `mutate()`.
## i In argument: `Year = as.numeric(Year)`.
## Caused by warning:
## ! NAs introduced by coercion
```

```r
fluidmilk_data <- fluidmilk_data %>%
  mutate(across(Whole_Milk:Total_Sales, as.numeric))

print(fluidmilk_data)
```

```
## # A tibble: 49 x 10
##     Year Whole_Milk `Reduced_Fat_2_%` `Low_Fat_1_%`  Skim Flavored_Whole
##    <dbl>      <dbl>             <dbl>         <dbl> <dbl>          <dbl>
##  1  1975      36188              8726          2742  2480           1366
##  2  1976      35241              9556          2875  2524           1475
##  3  1977      34036             10423          3003  2617           1446
##  4  1978      33235             11017          3233  2543           1359
##  5  1979      32480             11762          3281  2604           1236
##  6  1980      31253             12435          3483  2636           1075
##  7  1981      30397             13088          3574  2583            843
##  8  1982      29350             13501          3537  2449            710
##  9  1983      28871             14183          3455  2474            749
## 10  1984      28204             15143          3382  2726            907
## # i 39 more rows
## # i 4 more variables: Flavored_Other <dbl>, Buttermilk <dbl>, Eggnog <dbl>,
## #   Total_Sales <dbl>
```

```r
key_stats <- fluidmilk_data %>%
  summarise(
    across(everything(), list(mean = mean, sd = sd, min = min, max = max), na.rm = TRUE)
  )
```

```
## Warning: There was 1 warning in `summarise()`.
## i In argument: `across(...)`.
## Caused by warning:
## ! The `...` argument of `across()` is deprecated as of dplyr 1.1.0.
## Supply arguments directly to `.fns` through an anonymous function instead.
##
##   # Previously
##   across(a:b, mean, na.rm = TRUE)
##
##   # Now
##   across(a:b, \(x) mean(x, na.rm = TRUE))
```

```r
print(key_stats)
```

```
## # A tibble: 1 x 40
##   Year_mean Year_sd Year_min Year_max Whole_Milk_mean Whole_Milk_sd
##       <dbl>   <dbl>    <dbl>    <dbl>           <dbl>         <dbl>
## 1      1999    14.3     1975     2023          20872.         6578.
## # i 34 more variables: Whole_Milk_min <dbl>, Whole_Milk_max <dbl>,
## #   `Reduced_Fat_2_%_mean` <dbl>, `Reduced_Fat_2_%_sd` <dbl>,
## #   `Reduced_Fat_2_%_min` <dbl>, `Reduced_Fat_2_%_max` <dbl>,
## #   `Low_Fat_1_%_mean` <dbl>, `Low_Fat_1_%_sd` <dbl>, `Low_Fat_1_%_min` <dbl>,
## #   `Low_Fat_1_%_max` <dbl>, Skim_mean <dbl>, Skim_sd <dbl>, Skim_min <dbl>,
## #   Skim_max <dbl>, Flavored_Whole_mean <dbl>, Flavored_Whole_sd <dbl>,
## #   Flavored_Whole_min <dbl>, Flavored_Whole_max <dbl>, ...
```

The dataset covers years from 1975 to 2023, with a mean year of around 1999. This indicates the dataset spans a considerable period, allowing for a long-term trend analysis.The mean value for "Whole Milk" sales is approximately 20,871.73 units. Based on the table, it appears that whole milk sales have generally decreased over time, as the earlier years show higher values than might be expected based on recent years. This might suggest a trend away from whole milk consumption over time.Similar trends might be visible in the data for "Reduced Fat 2%", "Low Fat 1%", and "Skim" milk types, which would be useful to confirm with visualizations.

```
library(ggplot2)
library(readxl)
library(dplyr)
library(tidyr)


file_path <- "fluidmilk.xlsx"
fluidmilk_data <- read_excel(file_path, sheet = "fluidmilk")
```

```
## New names:
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```

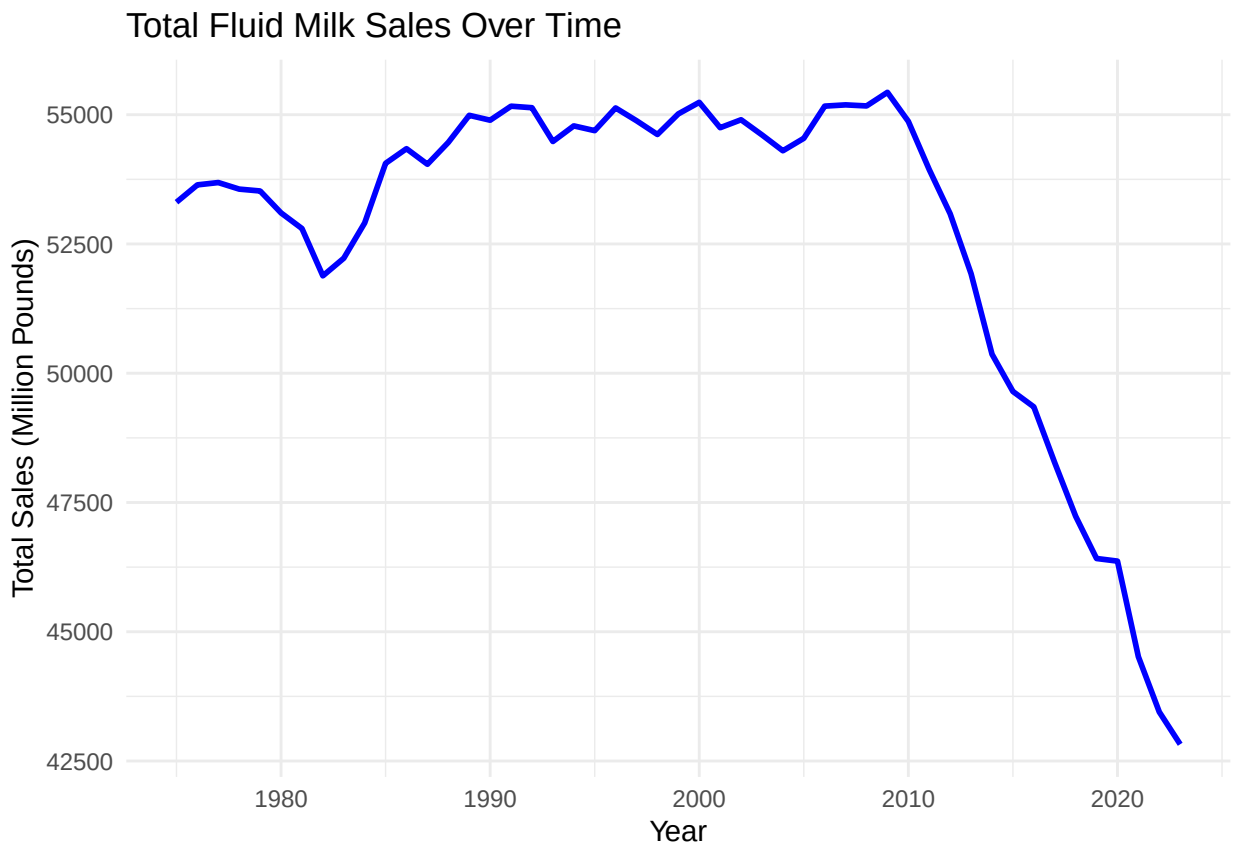
```
colnames(fluidmilk_data) <- c("Year", "Whole_Milk", "Reduced_Fat_2_Percent",
                              "Low_Fat_1_Percent", "Skim", "Flavored_Whole",
                              "Flavored_Other", "Buttermilk", "Eggnog", "Total_Sales")


fluidmilk_data <- fluidmilk_data %>%
  mutate(Year = as.numeric(Year)) %>%
  filter(!is.na(Year)) %>%
  mutate(across(Whole_Milk:Total_Sales, as.numeric))
```

```
## Warning: There was 1 warning in `mutate()`.
## i In argument: `Year = as.numeric(Year)`.
## Caused by warning:
## ! NAs introduced by coercion
```

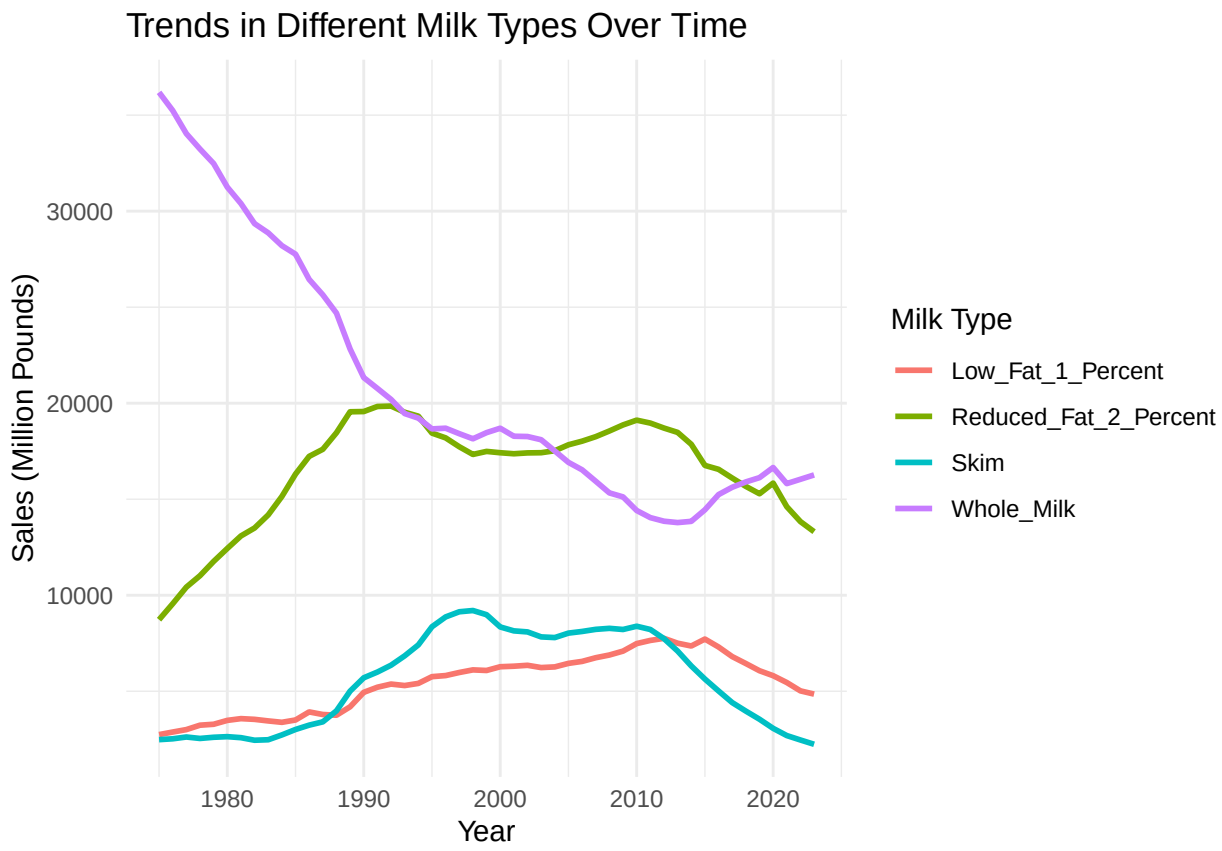
```
# 1. Line Plot
ggplot(fluidmilk_data, aes(x = Year, y = Total_Sales)) +
  geom_line(color = "blue", size = 1) +
  labs(title = "Total Fluid Milk Sales Over Time", x = "Year", y = "Total Sales (Million Pounds)") +
  theme_minimal()
```

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```



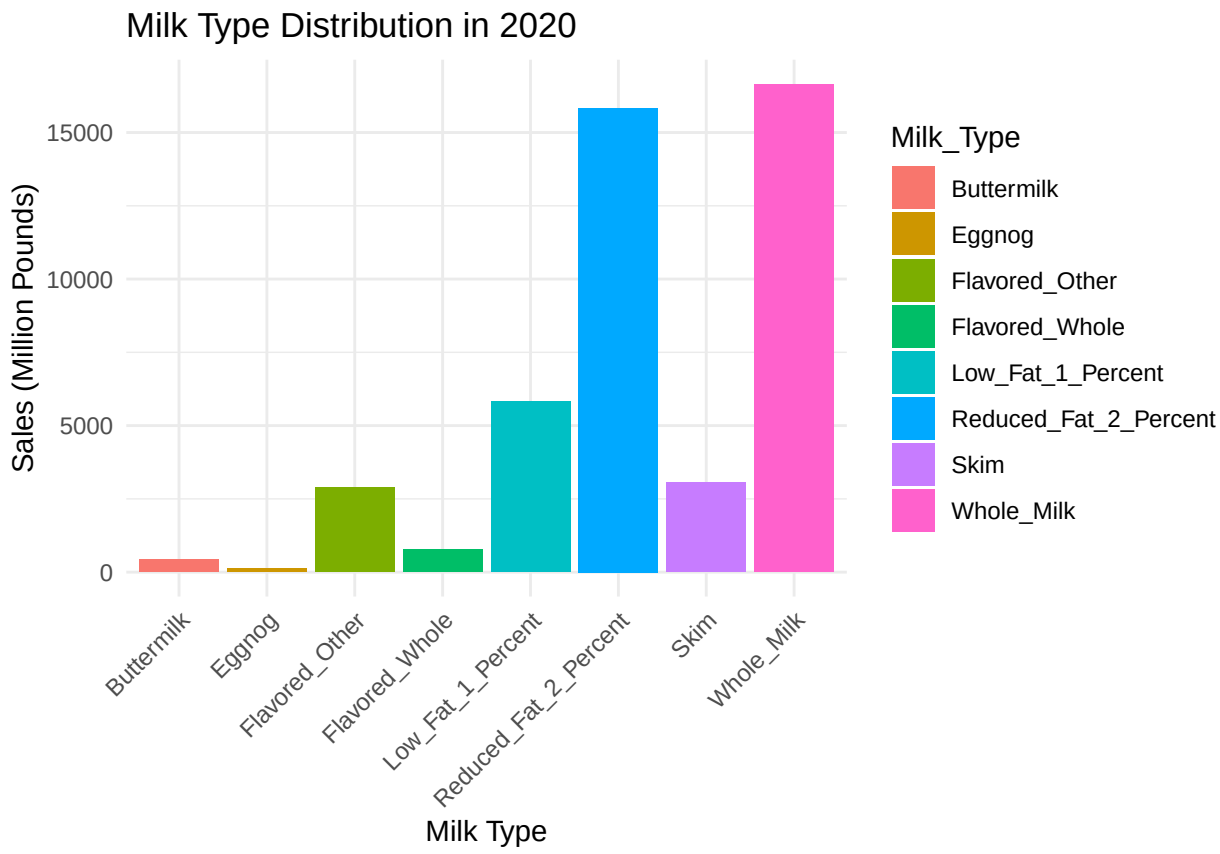

```
# 2. Line Plot
fluidmilk_long <- fluidmilk_data %>%
  select(Year, Whole_Milk, Reduced_Fat_2_Percent, Low_Fat_1_Percent, Skim) %>%
  pivot_longer(cols = -Year, names_to = "Milk_Type", values_to = "Sales")

ggplot(fluidmilk_long, aes(x = Year, y = Sales, color = Milk_Type)) +
  geom_line(size = 1) +
  labs(title = "Trends in Different Milk Types Over Time", x = "Year", y = "Sales (Million Pounds)", co
  theme_minimal()
```

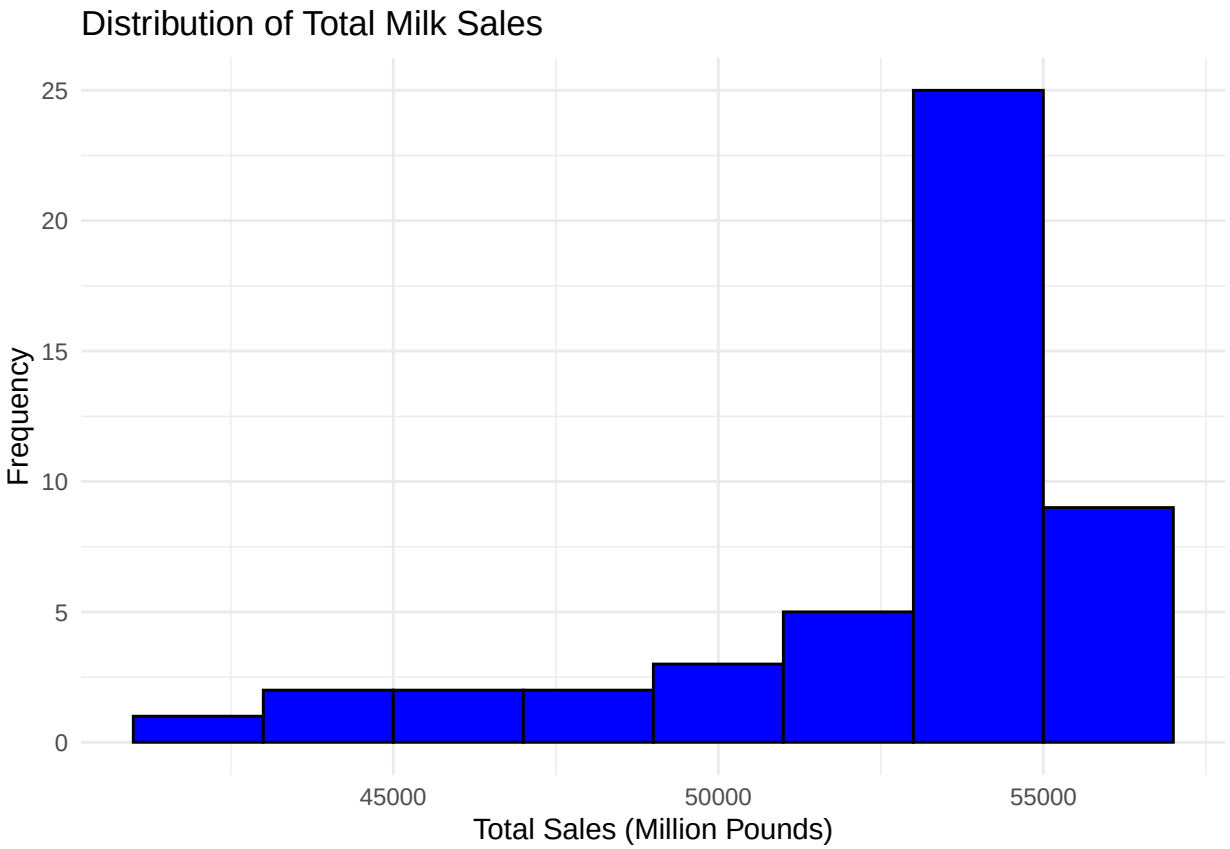



```r
# 3. Bar Plot
milk_2020 <- fluidmilk_data %>%
  filter(Year == 2020) %>%
  select(Whole_Milk, Reduced_Fat_2_Percent, Low_Fat_1_Percent, Skim, Flavored_Whole, Flavored_Other, Bu
  pivot_longer(cols = everything(), names_to = "Milk_Type", values_to = "Sales")

ggplot(milk_2020, aes(x = Milk_Type, y = Sales, fill = Milk_Type)) +
  geom_bar(stat = "identity") +
  labs(title = "Milk Type Distribution in 2020", x = "Milk Type", y = "Sales (Million Pounds)") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```




```
# 4. Histogram:
ggplot(fluidmilk_data, aes(x = Total_Sales)) +
  geom_histogram(binwidth = 2000, fill = "blue", color = "black") +
  labs(title = "Distribution of Total Milk Sales", x = "Total Sales (Million Pounds)", y = "Frequency") +
  theme_minimal()
```



1. line plot:

a.Growth Period (1975 to mid-1980s): During this period, total fluid milk sales experienced steady growth, likely driven by population growth and increased demand for dairy products.

b.Plateau Phase (mid-1980s to around 2010): Sales remained relatively stable, indicating a period of sustained consumption where demand neither increased nor decreased significantly.

c.Decline Period (2010 to 2023): After 2010, a sharp and continuous decline in fluid milk sales is observed, reflecting a significant shift in consumer preferences and market trends.

the data suggests a major transformation in the dairy industry, particularly in the last decade, as consumer behaviors evolve. Understanding the underlying factors driving these trends would be key for stakeholders in the dairy market to adapt to these changes.

2. line plot:

a.The sales of whole milk have experienced a dramatic decline since 1975. Initially the dominant milk type, it steadily decreased as consumers shifted toward lower-fat alternatives, reflecting changing dietary preferences and health trends.

b. Reduced-Fat (2%) Milk: gained popularity starting in the late 1970s and peaked around the 1990s. However, its sales began to decline after 2010, mirroring the overall decline in fluid milk consumption.

c. Skim milk experienced gradual growth from the 1980s to the early 2000s, reflecting increasing health-consciousness. However, its sales have significantly declined since the mid-2000s, suggesting a loss of favor among consumers, possibly due to taste or the rise of alternatives.

d.Sales of 1% milk have remained relatively stable over the years, though they have seen a slight decline post-2010.

While there was a clear shift from whole milk to reduced-fat and skim milk during the late 20th century, all categories have experienced declining sales since 2010. This underscores a broader trend of declining fluid milk consumption, possibly driven by the rise of plant-based alternatives, changing dietary habits, and demographic shifts.

3. bar plot:

a.Whole Milk and Reduced-Fat 2% Milk are the most consumed milk types in 2020, showing they remain staples in consumer preferences despite the overall decline in milk consumption.

b.Skim Milk and Low-Fat 1% Milk have significantly lower sales compared to the top two categories. This suggests a decline in the popularity of these lighter milk options, possibly due to changing health trends or consumer taste preferences.

c. Flavored Milk, Buttermilk, and Eggnog have minimal sales volumes compared to standard milk types. These are likely niche products consumed in smaller quantities, perhaps for specific occasions or as specialty items.

The large sales gap between the primary and secondary/tertiary categories highlights consumer focus on traditional milk options over specialty or lighter alternatives.The consistent demand for Whole Milk may indicate a shift away from the health-driven trends of the 1990s and early 2000s, reflecting a return to taste and indulgence over reduced fat content.

4. Histogram:

a. The majority of years have total milk sales concentrated in the range of approximately 52,000 to 55,000 million pounds. This suggests that for a significant part of the observed period, milk sales were relatively stable and high.

b. There are fewer years with total milk sales below 50,000 million pounds. These years likely correspond to the more recent period (post-2010), where milk consumption began to decline sharply.

c.The distribution is right-skewed, indicating that while most years experienced high sales volumes, there is a noticeable tail on the left side reflecting the gradual decline in milk consumption in more recent years.

This plot highlights the decline in milk consumption as an emerging trend rather than the historical norm. It suggests that milk sales were robust for a majority of the observed period, with the decline being a more recent phenomenon.

Future project ideas:

1. Provide a comprehensive analysis of how milk sales have evolved over time and what factors may have driven these changes.

2. Examine how consumer preferences have shifted between milk types over the decades.

3.Investigate the factors contributing to the sharp decline in fluid milk sales post-2010.

4. : Analyze milk consumption trends by region or demographic