VİSUALİZİNG PUBLİC PERCEPTİON AND USAGE OF COOKWARE AND FOOD STORAGE MATERİALS: A MİXED VİSUALİZATİON APPROACH

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Objective:

This study aimed to investigate consumers' usage frequency and safety perceptions toward various cookware and food storage materials. Visual analytics were employed to uncover key trends in cooking and storage preferences related to food-contact materials.

Key Findings:

Glass and stainless steel rank highest in both frequency of use and safety perception.
Reused plastics and aluminum containers are still in use but are perceived as less safe, indicating a knowledge gap.
Visual tools helped expose clear patterns between perceived health risks and consumer behavior.

Material Type	Never (%)	Sometimes (%)	Often (%)	Don't Know (%)	Unsafe (%)	Moderately Safe (%)	Safe (%)
Cooking Containers							
Copper cookware	48.6	46.6	4.8	26	16.8	25.5	31.7
Cast iron cookware	20.3	54.5	25.2	19.7	7.2	19.3	53.8
Aluminum cookware	45.9	45	9.1	21.2	36.4	26.8	15.5
Stainless steel cookware	6.5	33.5	60	13.1	3.3	11.3	72.3
Earthenware (clay)	34.7	56.9	8.4	22.5	9.1	17.1	51.4
Glass cookware	11.2	42.4	46.4	11.4	3	9.5	76.1
Ceramic cookware	28.8	52.5	18.7	24.3	8	18.8	49
Enamel cookware	44.4	44.6	10.9	35.3	18	28.7	18
Teflon (non-stick) cookware	10	42.8	47.2	16.8	16.9	25.9	40.5
Titanium-coated cookware	54.7	34.1	11.3	50.6	12.4	15.2	21.8
Granite cookware	26.6	42.9	30.4	32.5	9.6	18	39.8
Porcelain	32.1	38.8	29.1	31.3	5.9	15	47.8
Food Storage Containers							
Reused plastic (e.g., ice cream tubs, bottles)	28.1	57.1	14.7	10.5	50.6	27.9	11
Plastic containers	14.3	61.2	24.5	8.9	46.9	36	8.3
Glass containers	4	28.1	67.9	7.4	3.6	8.1	80.9
BPA-free labeled plastic containers	29.8	47.8	22.4	34.3	7.5	18.8	39.4
Metal (stainless steel) containers	21.2	43.8	35.1	18.2	6.3	15.3	60.1
Metal (aluminum) containers	50.6	37.7	11.7	28.2	32	22	17.8
Cookware used as storage (e.g., pots/pans)	11.9	48.9	39.2	20.9	11.7	25.6	41.8

Dataset and Methodology:

A cross-sectional dataset obtained via an online questionnaire (n = 1546 adults). Data were visualized using R and the following packages: ggplot2, ggalluvial, treemapify, dplyr, forcats
Graph types used: Sankey diagram, Treemap, and Barchart.

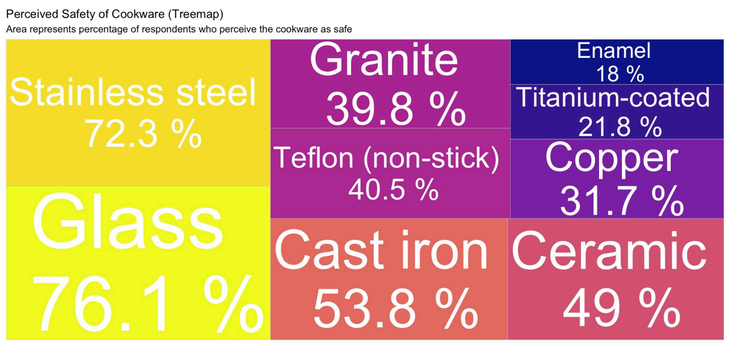


Figure 1. Perceived Safety of Cookware (Treemap)

This treemap illustrates the percentage of consumers who perceive various types of cookware as safe. Each box's size reflects the proportion of respondents rating the item as "safe."
Glass cookware is perceived as the safest (76.1%), followed by stainless steel (72.3%) and cast iron (53.8%). Teflon (non-stick) and ceramic show moderate safety perceptions (40.5% and 49% respectively).
Materials like titanium-coated (21.8%) and enamel (18%) are considered less safe by the majority of respondents.
The color gradient (yellow to dark purple) visually encodes the degree of perceived safety, aligning with the percentage values.

Figure 2. Safety Perception of Cooking and Storage Containers (Stacked Bar Chart)

This bar chart displays the perceived safety levels of various container types used for cooking and food storage, based on participant responses.
Glass cookware (87%) and stainless steel (86%) are seen as the safest options for cooking.
Aluminum cookware ranks the lowest in perceived safety, with only 37% considering it safe and 36% rating it as unsafe. For food storage, glass containers again lead with 88% safety perception, followed by stainless steel (79%) and BPA-free plastics (73%). Reused plastic containers and standard plastic containers have the highest unsafe ratings, at 51% and 47%, respectively.
The green-yellow-red color scheme highlights the safety gradient from safe to unsafe, making the perception differences across container types immediately clea

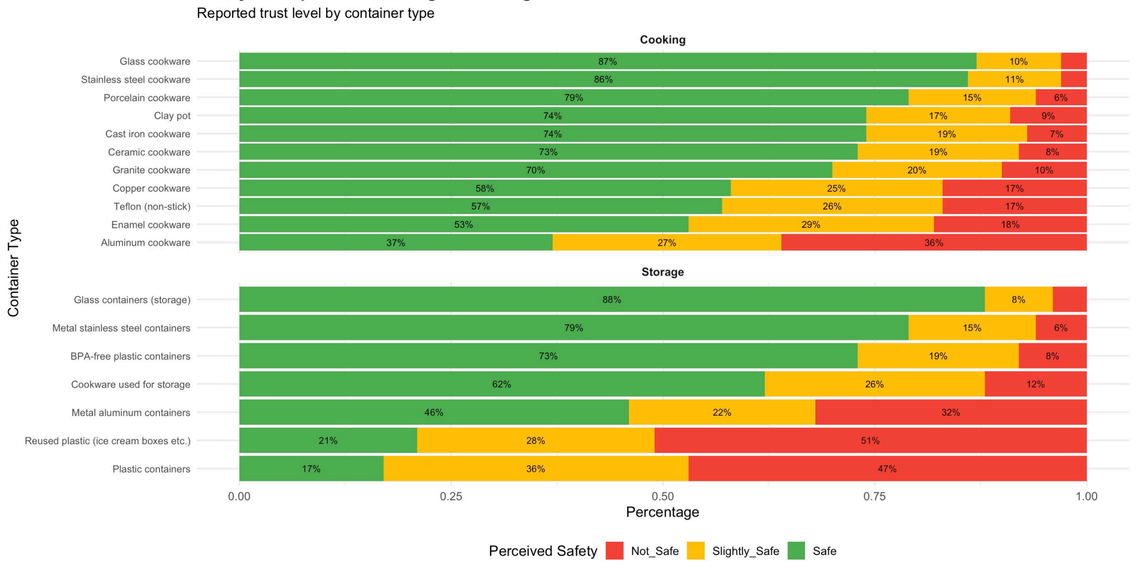


Figure 3. Usage Frequency of Cooking and Storage Containers (Stacked Bar Chart)

This chart presents how often different types of cookware and storage containers are used by consumers, divided into three categories: "Never," "Sometimes," and "Often."
Cooking Containers:
Stainless steel (60%) and Teflon-coated (47%) cookware are the most frequently used types.
Glass cookware is also widely used (46%), despite slightly lower "often" usage than stainless steel.
Materials like copper (8%) and clay pots (8%) are used least frequently, with a high share of respondents reporting "never" use.
Storage Containers
Glass containers are by far the most frequently used (68% often), followed by cookware used for storage (49%).
BPA-free plastic and plastic containers show high rates of "sometimes" usage, with lower "often" ratings (22–24%).
Aluminum and reused plastic containers are mostly avoided, with 51% and 57% indicating "never" usage, respectively.
The red-blue-green coding makes it easy to identify usage habits across materials, aiding in the comparison between preferred and avoided items.

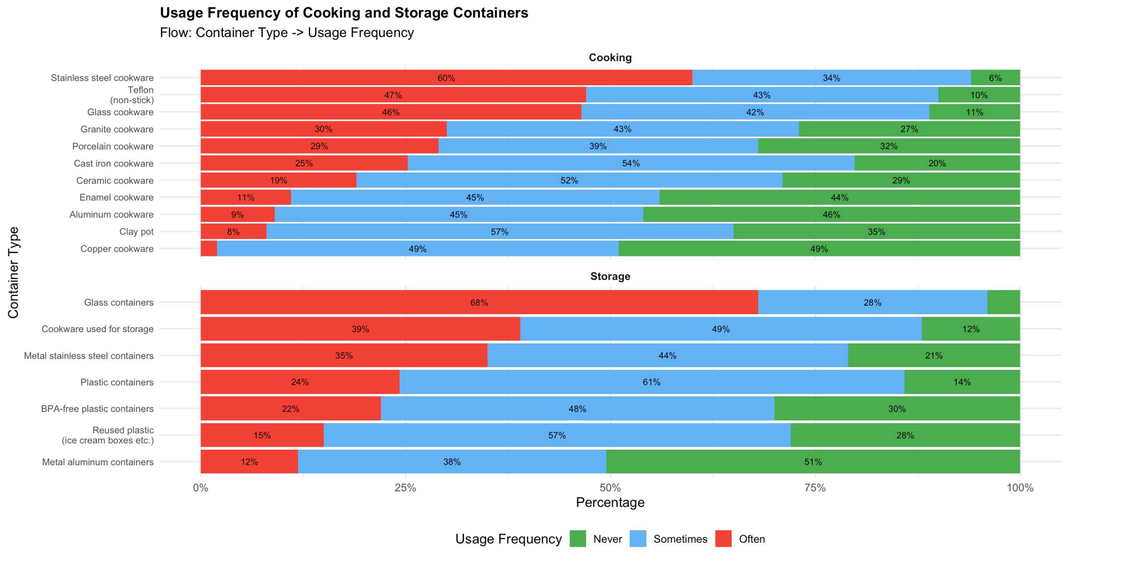
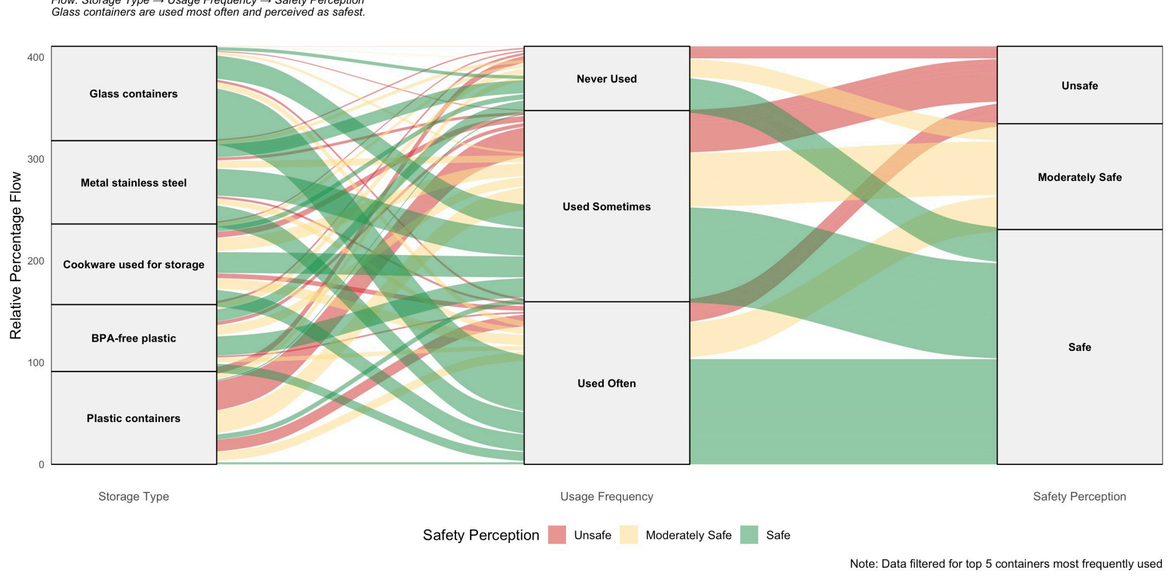


Figure 4. Sankey Diagram: Usage and Safety Perception of Top 5 Storage Containers

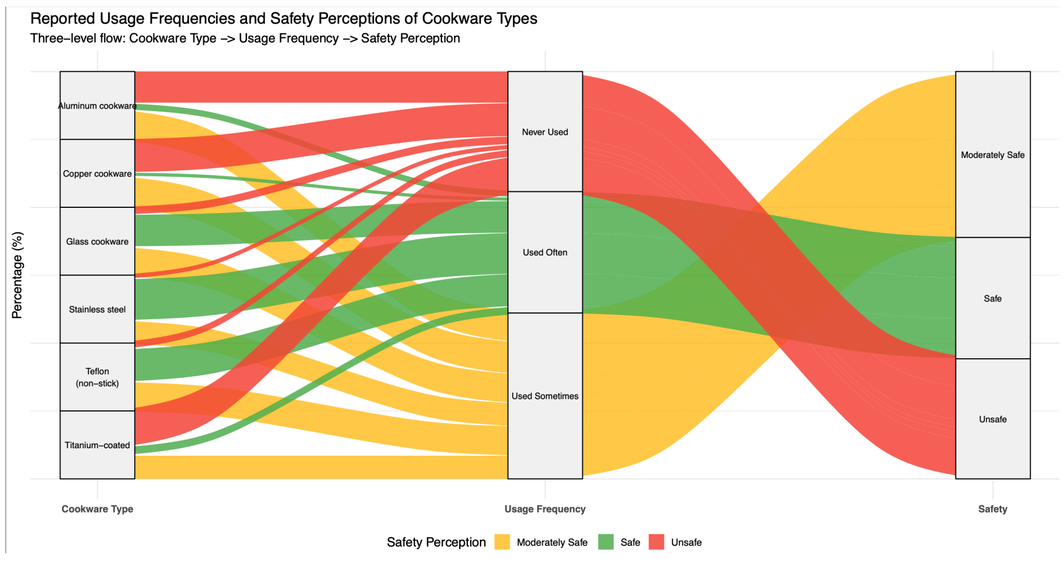
This Sankey diagram illustrates the relationship between storage container type, usage frequency, and safety perception based on consumer responses.Glass containers are most frequently used and have the strongest flow toward the "Safe" category. Plastic containers, while also frequently used, show significant flow into the "Moderately Safe" and "Unsafe" categories. Cookware used for storage and stainless steel containers generally flow toward moderate and high safety perception levels. BPA-free plastic containers have mixed perception patterns, with no clear dominance toward "Safe."
This visual clearly shows that frequent usage does not always equate to higher perceived safety, especially for plastics. It highlights the complex interplay between habit and trust, making it a key insight for food safety awareness campaigns.



Note: Data filtered for top 5 containers most frequently used

Figure 5. Sankey Diagram: Usage and Safety Perception of Cookware Types

This three-level Sankey diagram maps the flow from cookware type to usage frequency and then to perceived safety. Glass and stainless steel cookware show strong connections to both "Used Often" and "Safe" categories, confirming their favorable perception and frequent use. Teflon-coated cookware is frequently used but flows more toward "Moderately Safe," suggesting cautious trust. Titanium-coated, copper, and aluminum cookware types demonstrate high flow toward the "Unsafe" category, especially from those who "Never Use" them. This visualization highlights how safety perception influences or reflects usage behaviors, especially for controversial materials like aluminum.
The colored flows (green = safe, yellow = moderately safe, red = unsafe) visually encode public trust in different cookware materials.



REFERENCES AND TOOLS:
DATA SOURCE: AUTHOR'S ORİGİNAL SURVEY ON CONSUMER BEHAVİOR REGARDİNG FOOD-CONTACT MATERİALS İN TÜRKİYE.
SOFTWARE: R (V4.X)
PACKAGES: GGPLOT2, GGALLUVİAL, TREEMAPİFY, DPLYR, FORCATS