# Consumer Awareness of Harmful Effects of Reheating and Using of Plastic Containers for Cooking

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## Abstract

The busy lifestyle of has made women to find out faster ways to cook and reheat food. Entry of microwaves in kitchen has made cooking easier and faster. Microwave containers are made up of glass, clay and plastics. Though glass and clay containers are the safest to use but plastic containers are handy, easy to use, unbreakable and convenient for the consumers. When consumers are increasingly buying plastic containers the present study examines consumer awareness regarding harmful effects of using plastic containers for cooking and reheating in microwaves. For the study a sample of 150 was considered in Delhi and NCR. The precondition of the study was only those respondents were considered who were using the microwave at either for reheating or cooking.

## Introduction

Today in this fast changing lifestyle of people due to urbanization, where more number of working women leading to the increasing dual family income, small nuclear families along with increasing literacy rates. The busy lifestyle of has made women to find out faster ways to cook and reheat food. Therefore microwave is becoming an indispensable part of our life. Microwaves have made cooking easier and faster. In the mircowaves the containers that can be used are of glass, clay and plastics. Though glass and clay containers are the safest to use but plastic containers are handy, easy to use, unbreakable and convenient for the consumers and their use is increasing day by day.

Plastics are made of using oil and natural gas and are easily mass produced compared with paper or glass that is why these containers are easily available and predominantly used.

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In addition, the development of new plastics materials have further increased their application potential and as such have been substituted for larger and heavier material, glass or multi-material structures. These technological advances in plastic manufactures have assured the increasing use plastic containers.

## Literature Review

Unlike glass, plastics are not inert to foods. Aside from permeation of gases and vapors it is possible that components of plastic can migrate into food and be consumed with food even while heating the food in the container. Likewise substances stored inside the plastic container either by adsorption into the body of plastic[1]

The U.S. Food & Drug Administration (FDA) requires that plastics used in food packaging be of greater purity than plastics used for non-food packaging. This is commonly referred to as **food grade** plastic. Plastics used to package pharmaceuticals are held to an even higher standard than food grade[2]

Food grade plastic does not contain dyes or recycled plastic deemed harmful to humans. However, this does not mean that food grade plastic cannot contain recycled plastic. The FDA has detailed regulations concerning recycled plastics in food packaging.

There are various types of plastics as mentioned in Table 1.

**Grade 1** plastics known as **PET** or **PETE** (polyethylene terephthalate) is a clear, tough polymer with exceptional gas and moisture barrier properties. PET's ability to contain carbon dioxide (carbonation) makes it ideal for use in soft drink bottles.

**Grade 2** plastics known as **HDPE** (high density polyethylene) is used in milk, juice and water containers in order to take advantage of its excellent protective barrier properties. Its chemical resistance properties also make it well suited for items such as containers for household chemicals and detergents.

**Grade 3** plastics known as **Vinyl** (polyvinyl chloride, or PVC) provides excellent clarity, puncture resistance and cling. As a film, vinyl can breathe just the right amount, making it ideal for packaging fresh meats that require oxygen to ensure a bright red surface while maintaining an acceptable shelf life.

**Grade 4** plastics are **LDPE** (low density polyethylene) offers clarity and flexibility. It is

used to make bottles that require flexibility. To take advantage of its strength and toughness in film form, it is used to produce grocery bags and garbage bags, shrink and stretch film, and coating for milk cartons.

**Grade 5** known as **PP** (polypropylene) has high tensile strength, making it ideal for use in caps and lids that have to hold tightly on to threaded openings. Because of its high melting point, polypropylene can be hot-filled with products designed to cool in bottles, including ketchup and syrup. It is also used for products that need to be incubated, such as yogurt. Many Combo, Tupperware and Rubbermaid food storage containers use this plastic.

**Grade 6** known as **PS** (polystyrene), in its crystalline form, is a colorless plastic that can be clear and hard. It can also be foamed to provide exceptional insulation properties. Foamed or expanded polystyrene (EPS) is used for products such as meat trays, egg cartons and coffee cups. It is also used for packaging and protecting appliances, electronics and other sensitive products.

**Grade 7** called **Others** denotes plastics made from other types of resin or from several resins mixed together. These usually cannot be recycled. Another important type of plastic is **polycarbonate**; a clear shatter-resistant material used in restaurant food storage containers and the Rubbermaid Premier line of stain-resistant home food storage containers.

**Table 1: Plastics and its types**

| Symbol | Type of Plastic | Products Packaged (Examples) |
|---|---|---|
| 1 PETE | PET Polyethylene Terephthalate | Most convenience-size beverage bottles, mouthwash bottles, boil-in-bag pouches |
| 2 HDPE | HDPE High Density Polyethylene | Milk jugs, trash bags, ice cube trays, storage containers |
| 3 PVC | PVC Polyvinyl Chloride (DEHP) | Cooking oil bottles, packaging around meat, some baby bottle nipples, beverage pitchers |
| 4 LDPE | LDPE Low Density Polyethylene | Produce bags, food wrap, bread bags, zip-lock bags, baby bottle liners |
| 5 PP | PP Polypropylene | Yogurt containers, straws, margarine tubs, spice containers |
| 6 PS | PS Polystyrene | Styrofoam cups and containers, take-home boxes, egg cartons, meat trays |
| 7 OTHER | Other (Bisphenol A) | Polycarbonate baby bottles, 5-gallon water cooler bottles, meat trays, toddler fruit cups |

Source: FDA Report 2011

When food is placed in plastic containers in the microwave, depending on the amount of time used for heating food and the temperature being set, chemicals used to produce the plastic may leak into your food. The FDA is aware of this problem and mandates that manufacturers of plastic food containers test their products to be sure that this danger does not exist. From Grade 1 to 4 are not microwave safe. Most takeout containers, water bottles, and plastic tubs or jars made to hold margarine, yogurt, whipped topping, and foods such as cream cheese, mayonnaise, and mustard are not microwave-safe.

While Grades 5,6 and 7 are food grade plastics and are manufactured by branded companies as a cookware for kitchen. Microwavable takeout dinner trays are formulated for one-time use only and will say so on the package.

Plastic containers are highly being used but they have harmful effects which a consumer might not be aware off while using them for reheating and cooking. When plastic containers are exposed to heat, resins and synthetic chemicals are released into our food and beverages known as leaching. Plastics leach toxic chemicals when they are exposed to heat from the dishwasher, microwave or hot liquids. Plastics made from BPA, such as polycarbonate and epoxy resins, leach the fastest when exposed to heat[3]

Biphenyl A(BPA) used in plastic containers is linked to breast cancer. BPA binds to the same receptors in the body as estrogen, promoting the growth of cancer cells. Chemicals that leach out from plastic containers are also linked to prostate cancer, as chemicals store inside body fat, thereby elevating the risk. Additionally, chemicals used in plastic containers such as food packaging and water bottles have also been linked to diabetes. Continual exposure to these chemicals causes insulin resistance that leads to type II diabetes[4]

## Research Methodology:

In spite of the fact that plastic containers are harmful but still plastic containers are increasing being used, which a consumer might not be aware off while using them for reheating and cooking this leads to to check the awareness of consumers while buying a plastic container for cooking and heating food. So the research question is, are consumers aware of plastics harmful effects?

Research Problem is Consumer awareness regarding harmful effects of reheating and reusing of plastic containers. The study uses the Non-Probability sampling (convenience sampling). Convenience sampling is not systematic proportionate of complete population but is purely based on convenience of researcher. Sample sizes of 150 customers were taken covering the areas of Delhi and NCR. The study was undertaken within 3 months of time period due to which convenience sampling was adopted for the study.

### Research Objectives

The objectives of this research study are:

- To study about plastics and its types.

- To examine the awareness level of harmful effects of plastics for purpose of reheating and reusing.
- To examine factors influencing while buying of plastics containers.

**Interpretation of Results:**

## Table 3 : Respondents Profile

| **Age** | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| 15-25 yrs | 65 | 43.3 | 43.3 | 43.3 |
| 26-35 yrs | 54 | 36.0 | 36.0 | 79.3 |
| 36 yrs and above | 31 | 20.7 | 20.7 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |
| **Gender** | | | | |
| Female | 113 | 75.3 | 75.3 | 75.3 |
| Male | 37 | 24.7 | 24.7 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |
| **Qualification** | | | | |
| Graduate | 84 | 56.0 | 56.0 | 56.0 |
| Post graduate | 66 | 44.0 | 44.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

From Table 3, the sample of 150, Age wise respondents under study were 65 (43.3%) within the age of 15-25 years, 54 (36%) within age of 26-35 years and 31 (20.7%) of them were above age of 36 years and above. Gender wise respondents, 113 (75.3%) of females and 37 (24.7%) of them were males. Qualification wise respondents, 84 (56%) graduate and 66 (44%) of them were post graduate.

## Table 4: Use of Microwave for Cooking and Reheating

| Frequency | | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Yes | 144 | 96.0 | 96.0 | 96.0 |
| No | 6 | 4.0 | 4.0 | 100.0 |
| Total | 150 | 100.0 | 100.0 | |

In Table 4, From the 150 respondents, 144 (96%) use microwave for cooking and reheating whereas 6 (4%) don't use microwave for cooking and reheating. Where further it was found that respondents were using plastic container (135) followed by use of glass container (124) and bone china containers (64).

## Table 5: Identification that a Particular Container is Microwave Safe

| Microwave Safe | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 125 | 83.4 | 83.4 | 89.9 |
| | No | 25 | 16.6 | 16.6 | 100.0 |
| Total | | 150 | 100.0 | | |

In Table 5, the above 150 respondents 125 (83.3%) identify that plastic container is microwave safe and where as 25 (10.1%) are not able to identify that plastic container is microwave safe. Either they don't use microwave or they don't use plastic container.

**Table 6: Awareness of Symbols on Plastic Containers**

| Awareness | | Frequency | Percent | Valid Percent |
|---|---|---|---|---|
| Valid | Yes | 65 | 43.3 | 43.3 |
| | No | 85 | 56.6 | 56.6 |
| | Total | 150 | 100 | 100.0 |

In Table 6, respondents 65 (43.3%) they identify the food safe symbol whereas 85 (56.6) don't identify the food safe symbols. In spite of the fact respondents are educated but still almost 57% of

them are not aware of the symbols represented on the containers while buying. The symbols used by companies due guidelines of Government are mentioned below:

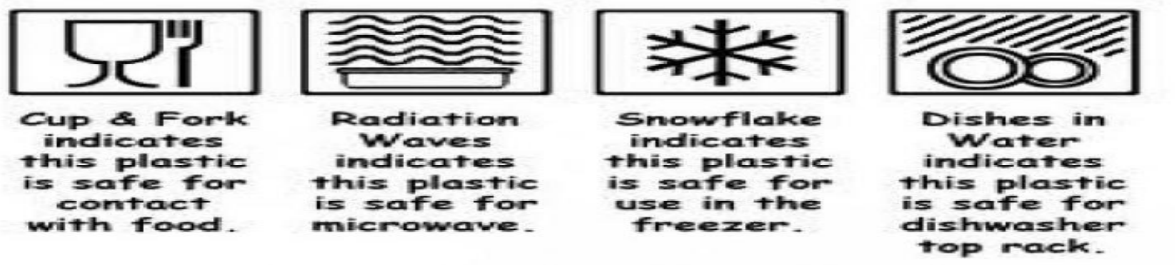


**Table 7: Age wise Anova Test on variables considered important while purchasing plastic containers**

| | **15-25yrs (N=62)** | | **26-35 yrs (N=49)** | | **36 and above (N=27)** | | **F- TEST** | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | Mean | SD | Mean | SD | Mean | SD | F | Sig. |
| 1) Cooking | 4.16 | 0.834 | 3.92 | 1.096 | 3.74 | 1.196 | 1.843 | 0.162 |
| 2) Reheating | 4.23 | 0.876 | 4.33 | 0.826 | 4.04 | 1.192 | 0.845 | 0.432 |
| 3) Storage | 4.18 | 0.915 | 4.04 | 0.957 | 3.74 | 1.289 | 1.753 | 0.177 |
| 4) Symbols on plastic | 3.6 | 1.078 | 3.65 | 1.128 | 3.7 | 1.137 | 0.095 | 0.909 |
| 5) Food grade plastic | 3.92 | 0.893 | 4.27 | 0.908 | 3.78 | 1.188 | 2.789 | 0.065 |
| 6)Temperature instructions | 3.69 | 0.861 | 3.92 | 1.205 | 3.44 | 1.251 | 1.744 | 0.179 |
| 7) Maintenance | 3.76 | 0.862 | 4.0 | 1.052 | 3.81 | 1.21 | 0.809 | 0.448 |
| 8) Brand | 3.9 | 0.863 | 3.96 | 1.02 | 4.63 | 0.565 | **7.021** | **0.001** |
| 9) Quality | 4.44 | 0.59 | 4.55 | 0.709 | 4.78 | 0.424 | 2.979 | 0.054 |
| 10) Price | 3.84 | 0.814 | 3.55 | 1.022 | 3.85 | 1.134 | 1.466 | 0.234 |
| 11) Recyclable | 3.35 | 1.073 | 3.41 | 1.135 | 2.78 | 1.013 | **3.365** | **0.037** |
| !2) Design | 3.56 | 1.018 | 3.43 | 0.957 | 3.48 | 1.122 | 0.249 | 0.78 |
| 13) Capacity of container | 4.18 | 0.8 | 4.1 | 0.823 | 4 | 0.877 | 0.447 | 0.64 |
| 14) Packaging | 3.23 | 0.948 | 3.45 | 1.001 | 3.33 | 1.209 | 0.654 | 0.522 |
| 15) Purpose of use | 4.42 | 0.641 | 4.43 | 0.764 | 4 | 1.109 | **3.09** | **0.049** |
| 16) FDA Approved | 3.47 | 1.082 | 3.67 | 1.405 | 3.22 | 1.219 | 1.191 | 0.307 |
| 17) Sales promotion offers | 3.31 | 0.898 | 3.59 | 1.059 | 4.04 | 0.854 | **5.627** | **0.004** |
| 18) Discounts | 3.58 | 1.064 | 3.73 | 0.953 | 3.89 | 0.934 | 0.949 | 0.39 |
| 19) Weight | 3.37 | 0.979 | 3.41 | 1.098 | 3.44 | 1.251 | 0.047 | 0.954 |
| 20) Multipurpose | 4.21 | 0.813 | 4.37 | 0.809 | 4.63 | 0.839 | 2.511 | 0.085 |

From Table 7, Age wise significant difference has been found in the aspects of brand, quality and sales promotion offers. The variable Brand has f-value of 7.021 with a significant difference at 99% level where respondents within age of 36 years and above have mean value of 4.63 i.e. they consider brand as highly important aspect while purchasing plastic containers, followed by 26-35 years have mean value of 3.96 and 15-26 years has mean value of 3.8 respectively. This means respondents of all age group rely on the brand and consider it important and highly important while purchase.

Sales promotion offers has significant difference at 99% level with f-value 5.627where respondents within age of 15-25 years has mean value 3.31 consider it as neither important nor unimportant aspect whereas respondents within age of 26-35 years has mean value of 3.67 and above the age of 36 has mean value of 4.04 they consider sales promotion offers as important aspects while purchasing plastic containers.

Recyclable variable has f value of 3.365 with significant difference at 95% level where highest mean value of 3.41 is represented with age group 26-35 years followed by 3.35 of age 15-25 years indicating that the variable recyclable is important for them. While age 36 and above has mean value of 2.78 indicating recyclable variable is neither important nor unimportant for them.

**Conclusion and Recommendation:** The present study understands consumer awareness regarding harmful effects of using plastic containers for cooking and reheating in microwaves. This study was need of the time as gradually women are changing their pattern of cooking due to busy lifestyle and convenience associated with it. For the study a sample of 150 was considered in Delhi and NCR. The precondition of the study was only those respondents were considered who were using the microwave at either for reheating or cooking. From the study we conclude that 96% of the sample under study were using microwaves for reheating and cooking both. But when examined 125 i.e 83.4 % could identify that the particular plastic container was microwave safe. When further questioned on awareness of symbols used on plastic containers only 43.3% could identify the symbols on the plastic container, the remaining 85 i.e. 56.6% didn't even bother for look for the same. Age, income and education wise ANNOVA was applied to check the importance of various factors considered while purchase. Significant difference could only be noticed in age wise on factors like brand, recyclable and sales promotion offers. As an author in spite of the sample taken was either graduate or post graduate but still majority don't see instructions and symbols mentioned on the container, they leave it to the brand and its goodwill.

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