

## A Community-Based Observational Study on Knowledge, Attitude, and Practice of Single-Use Plastics Ban in Rural Puducherry, South India

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### ABSTRACT

**Background:** India's industries produce nearly 9,000,000 metric tons of disposable plastic annually. Government of Puducherry implemented a ban on single-use plastics from 1st August 2019. This study aimed to evaluate the knowledge, attitude, and practice (KAP) levels concerning the use and legislation of single-use plastics among rural Puducherry's community residents.

**Methods:** A 6-month community-based observational study was conducted in rural Puducherry using multistage random sampling among 450 households. A semi-structured questionnaire was administered to an adult member (aged > 18 years) in each household before and after the plastic ban. Data collection utilized the Epi-collect 5 application, and SPSS v16 was used for statistical analysis, employing paired t-test and chi-square test (p-value < 0.05)

**Results:** Mean age of study participants was 39.64 (13.23) years, nearly 57% of them were female. Before ban, 80.4% of the subjects were carrying their shopping contents using plastic bags provided by the seller in the rural area, whereas after ban implementation, it has reduced to 16.4%. Mean KAP score before ban was  $8 \pm 2.8$  (95% CI: 7.7-8.2) and after ban, it increased to  $15.2 \pm 1.8$  (95% CI: 15-15.4). The pre- and post-ban KAP scores differences were found to be statistically significant (p-value < 0.05). The perception of the law banning the use of plastic bags was found to be significantly higher in younger age group, female gender, and groups with higher educational and occupational status (p = 0.01)

**Conclusion:** The study results will be useful for planning future needs and Information, Education Communication strategies for effective implementation and plastic use reduction in future.

**Key words:** Plastic Ban, Single-Use Plastic, Observational Study, Community Residents, Rural Area

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## Introduction

The popularity of single-use plastics has increased in all countries, since they are affordable, widely available, and simple to use. It has been reported that more than nine million metric tons of disposable plastic are produced in industries of India (1). Only 9% of the plastic garbage has been recycled and 12% has been incinerated, while the rest was disposed of in landfills and dumped into the environment (2). Plastics are quite ubiquitous due to qualities including low weight, resistance to breakdown, durability, and affordability. These characteristics of plastics encourage people to use them, and in a long run the complications and expenses related to disposing of plastics will be a burden to the society (3). Plastic lingers in the environment for years after it is released and takes ages to disintegrate, according to research (4). Additionally, the production and burning plastics generate hazardous chemicals that contribute to environmental contamination (5). Water samples from plastic bottles typically included carcinogen Diethylhexyl phthalate, which has been linked to a number of health problems (6). Transition toward less harmful packing and shipping materials is of utmost importance. Consequently, "The Plastic manufacture, Sale and Usage Rules" (1999) as revised in 2003, have prohibited the production and sale of carry bags from virgin or recycled plastics. (3). However, consumer preference research has shown that a significant portion of individuals do not place a high priority on environmental considerations (7). Hence, the Plastic Waste Management Rules (2016) mandated a minimum thickness of 50 microns for plastic products (8). This study was conducted in rural areas where plastic ban was enforced. Most of research evidence on plastics usage awareness was from developed countries. Thus, this study will provide first insights about legislation among community residents in areas where plastic ban has been enforced in South-India. The purpose of this study was to assess the current knowledge levels among the community-residents regarding legislation and preparedness on plastic ban. In

addition, this study explored the pattern of plastics usage, reasons for popularity, awareness about health hazards, perception towards banning usage of plastic bags, consumers' attitudes towards the use of alternatives to plastic bags and the bottlenecks in shifting to these alternatives. The results of this study will be valuable in designing Information, Education Communication (IEC) strategies for successful law implementation and in planning future demands, which will help reduce plastic consumption.

The present research aimed to fill the gaps regarding usage of plastic in community where the plastic ban was proposed to be implemented. The objective of this study was to assess the knowledge, attitude, and practice (KAP) levels of usage and legislation regarding single-use plastics ban among community residents in rural Puducherry, South India.

## Methods

A community-based descriptive observational study was conducted for 6 months during May to October 2019 in the rural service areas affiliated to the tertiary care hospital, Puducherry South India. The participants included community residents aged  $\geq 18$  years from the selected village from rural field practice areas. According to the previous study conducted in Rajasthan, where the prevalence of using plastic bags was found to be 40% (8) with alpha 0.5%, CI = 95%, absolute precision 5%, and a non-response rate of 20%, using sample size formula:

$$n = \frac{z_{(1-\alpha)}^2 pq}{d^2}, \text{ where } n = \text{sample size}$$

$z$  = level of confidence according to standard normal distribution (for a level of confidence of 95%,  $z = 1.96$ .)

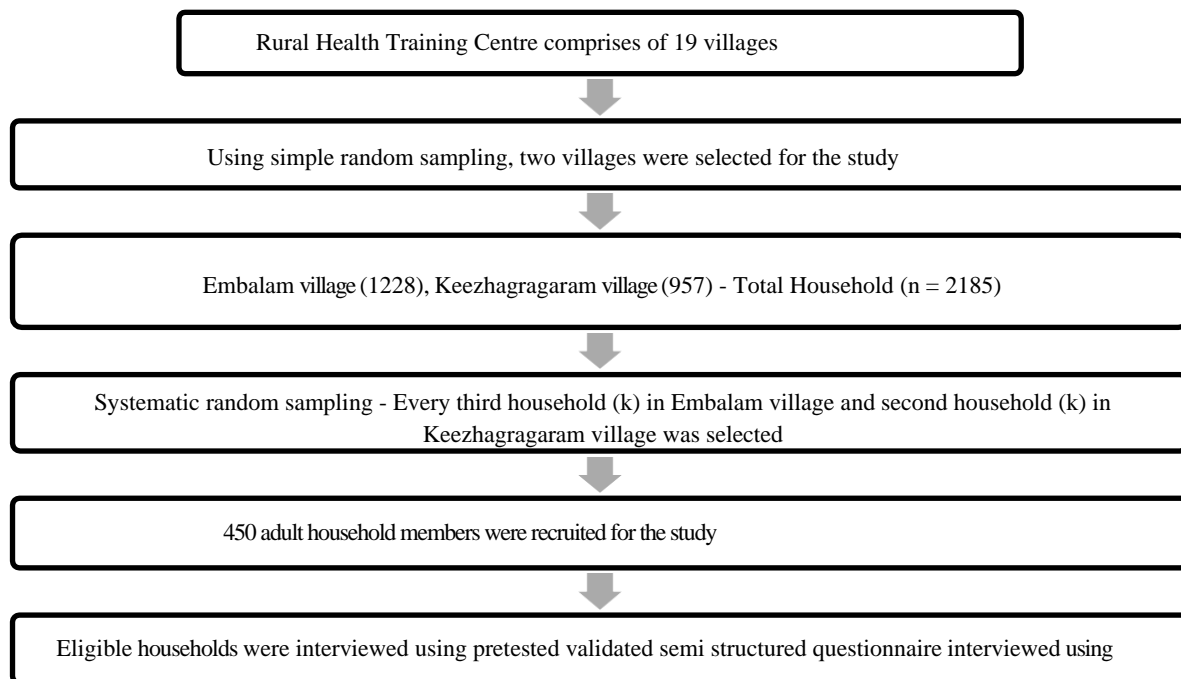
$p$  = estimated proportion of the population,  $q = (100 - p)$

$d$  = margin of error

The estimated sample size was 442 rounded off to the highest number of 450. Multistage random sampling technique was used. Puducherry government medical college rural field practice area includes 19 villages, out of which two villages

were chosen through simple random sampling. Households were selected in each of the two villages by systematic random sampling method. Each adult member ( $> 18$  years-preferably head of the family) in the selected household was interviewed. The inclusion criteria were people who were  $> 18$  years, residents of the selected

villages, and providing consent to participate in the study. The exclusion criteria were people who were not permanent residents of the selected rural villages, people who were not available even after three household visits, and seriously ill patients and known cases of major psychiatric disorders.



**Figure 1.** Sampling technique of the study

### Data analysis

Data were collected through interviews with a pre-tested and semi-structured questionnaire. The face and content validity were performed. Questionnaire included four parts. Part 1 contained socio-demographic profile of the participants. Part 2 had knowledge component questions with a total score of 6. Parts 3 and 4 were related to attitude and practice component questions with the total score of 6 and 8. The KAP scores of knowledge  $\geq 4$ , attitude  $\geq 3$ , and practice  $\geq 6$  were considered as good KAP scores. Using Epi-collect5, pre-ban data collection was completed among the selected villages. Puducherry government implemented a plastic ban on August 1, 2019. After one month of ban (wash-out period), post-ban data collection was done among the same residents. Institute Research Committee (IRC) and also IEC (Ref

No.5/186/IEC-25/PP/2019) approval was obtained before the start of the study. Data entry and analysis was done by Microsoft Excel 10 and SPSS software (version 16.0. Chicago, SPSS Inc; 2007). Chi-square and paired t-tests were used to determine statistical significance which was defined as a p-value less than 0.05.

### Results

Table 1 shows the socio-demographic profile of the study participants. The mean age of the participants was 39.64 (13.23) years and about 256 (56.9%) of them were female. Among the subjects, 410 (91.1%) residents belonged to Hindu religion. Middle and primary school level of education was observed in 142 (31.6%) subjects, while 118 (26.2%) subjects were illiterate. Unemployed individuals were 143 (31.8%) people, which could be due to the fact

that the participants were more selected from women and housewives. Moreover, 75 (16.7%) respondents were in the category of clerk/farmer/shop-owner. The median income of the respondents was 12000 INR (Indian rupees). Among the study population, joint families were more prevalent, accounting for 104 individuals (76.9%). Also, 196 (43.6%) households

had four family members, 100 (22.2%) households had five family members, and 91 (20.2%) households had three family members. Regarding the type of house, 192 (42.7%), 194 (43.1%), and 64 (14.2%) houses were pucca, semi-pucca, and kutcha houses, respectively.

**Table 1.** Socio-demographic profile of the participants

Socio-demographic variables	N (%)
<b>Age group n = 450</b>	
16-25	52 (11.6)
26-35	142 (31.6)
36-45	104 (23.1)
46-55	126 (28.0)
56-65	26 (5.8)
<b>Gender</b>	
Male	194 (43.1)
Female	256 (56.9)
<b>Religion</b>	
Hindu	410 (91.1)
Christian	13 (2.9)
Muslim	27 (6.0)
<b>Education</b>	
Graduate	37 (8.2)
Higher secondary school level	79 (17.6)
High school level	74 (16.4)
Junior high school and primary school level	142 (31.6)
Illiterate	118 (26.2)
<b>Occupation</b>	
Professional	37 (8.2)
Semi-professional	25 (5.6)
Clerk/shop-owner/Farmer	75 (16.7)
Skilled worker	51 (11.3)
Semi-skilled worker	55 (12.2)
Unskilled worker	64 (14.2)
Unemployed	143 (31.8)
<b>Type of family</b>	
Nuclear	46 (23.1)
Joint	104 (76.9)

Before ban, 80.4% of the subjects were carrying their shopping contents using plastic bags provided by the seller, whereas after ban implementation, it reduced to 16.4%. Before plastic ban, only 43.1% individuals were aware about the negative consequences of plastic usage, whereas after ban, it increased to 95.6%. The most common reasons for widespread use of plastics were lack of alternatives (61.3%) and easy availability (25.1%). Also, 213 (83.3%) participants were aware of the legislation prohibiting the use of plastics, and 261 (58 %) participants supported the legislation.

The most common reason for opposition was inconvenience caused while shopping cited by 89 (47%) participants, followed by the cost of an alternative mentioned by 75 (39.7 %) respondents. The perception of the law banning the use of plastic bags was found to be significantly higher in younger age group, female gender, and groups with higher educational and occupational status ( $p = 0.01$ ), Table 2.

**Table 2.** Association between perceptions of the single-use plastics ban and socio-demographic variables (n = 450)

Variables	In favour of ban (%)	Against ban (%)	Total	Chi-square value, p-value,
<b>Age (years)</b>				
19 – 25	39 (75)	13 (25)	52	
26 – 35	102 (71.8)	40 (28.2)	142	55.41,
36 – 45	67 (64.4)	37 (35.6)	104	0.001 *
46 – 55	40 (31.7)	86 (68.3)	126	
56 – 65	13 (50)	13 (50)	26	
<b>Gender</b>				
Male	93 (47.9)	101 (52.1)	194	14.17,
Female	168 (65.6)	88 (34.4)	256	0.001 *
<b>Educational status</b>				
Graduate	37 (100)	0	37	
Higher secondary	66 (83.5)	13 (16.5)	79	134.2,
High school	24 (32.4)	50 (67.6)	74	0.001 *
Primary and junior high school	42 (29.6)	100 (70.4)	142	
Illiterate	92 (78)	26 (22)	118	
<b>Occupation</b>				
Professional /Semi-professional	49 (79)	13 (21)	62	42.03,
Skilled workers	78 (61.9)	48 (38.1)	126	0.001 *
Semi /Unskilled workers	41(34.5)	78 (65.5)	119	
Unemployed	93 (65)	50 (35)	143	

\*Statistical significance: p-value &lt; 0.05

**Table 3.** Pre- and post- plastic ban KAP scores (n = 450)

Variables	Pre – ban Scores Mean $\pm$ SD (95% CI)	Post – ban Scores Mean $\pm$ SD (95% CI)	Paired t-test p - value
Knowledge	3.5 $\pm$ 1.7 (3.3 – 3.6)	5.6 $\pm$ 0.7 (5.5 – 5.6)	0.001 *
Attitude	2.99 $\pm$ 1.1 (2.8 – 3)	3.5 $\pm$ 1.1 (3.4 – 3.6)	0.001 *
Practice	1.5 $\pm$ 0.9 (1.4 – 1.6)	6.1 $\pm$ 1.1 (6.0 – 6.2)	0.002 *
Mean KAP score	8 $\pm$ 2.8 (7.7-8.2)	15.2 $\pm$ 1.8 (15-15.4)	0.001*

\*Statistical significance: p-value &lt; 0.05

Mean KAP score before ban was  $8 \pm 2.8$  (95% CI 7.7-8.2) and after ban, it increased to  $15.2 \pm 1.8$  (95% CI 15-15.4). The difference between the pre- and post-ban KAP scores was found to be statistically significant using a paired t-test (p-value < 0.05), Table 3.

## Discussion

In this study, the mean age of study participants was 39.64 (13.23) years and about 60% of them were female. Most residents belonged to Hindu religion. Similar findings were documented in another Indian study (9). But the findings related to educational and employment statuses were contrary in both studies. This could be attributed to the differences in study setting.

In the present study, most respondents were

aware of at least one health hazard posed by plastics. On the contrary, previous studies have reported less proportion of awareness on plastic associated health hazards ranging from 50% to 81% (4, 9, 10) Lack of alternatives and easy availability were pointed as common reasons for the use of plastic bags by participants in this study. This was similar to the findings of the study conducted in Delhi where convenience for shopping was the most common reason stated by most participants (10). Another Ethiopian research found that low price of plastic bags and availability were what made them popular among consumers (11).

The present study showed that younger age groups, female gender, higher educational status, and employment status were found to be strongly



associated with perception of the law prohibiting the use of plastic bags. A similar study from metropolitan city of South India reported an association (age group and educational status) between awareness about the hazards posed by single-use plastics and attitude towards governmental ban. However, there was no statistically significant difference in participants' awareness of plastic hazards according to their gender or occupation (12). Nearly 60% of the subjects reported that the current restriction was problematic, since there was no affordable alternative to plastic. Therefore, markets that offer discounted biodegradable bags could persuade customers to use the plastic bags less frequently. In Ireland and China, this strategy was found to minimize the use of plastic bags by 90% and 49%, respectively (13, 14).

In the present study, approximately 16.7% of the participants were uninformed that the government would implement a plastic ban. A study in New Delhi, India showed that most respondents did not have awareness regarding India's response and action towards plastic pollution (10). On the other hand, the store owners in this study provided plastic bags to their customers without even making sure they needed them. Similar findings were published from Capital city of India that certain shops routinely broke the law by giving their customers large numbers of plastic bags (3) causing customers and shopkeepers to ignore the plastic ban legislation. Public awareness campaigns have been ineffective in informing the public about the sanctions imposed by this law. A study by Xing X et al. in China found that the use of plastic bags markedly reduced when the plastic ban in the country. There has been a rise in public awareness of the need to preserve the environment from plastics (15).

In the current study, most participants were semi- or unskilled workers and about 42% of them opposed the ban on plastic bags. Similar results were found in Delhi, India, where 53% of low-income group members and 76% of housewives opposed the ban on plastic (11). Despite the fact that plastic bags cause health dangers, the majority

of housewives opposed the ban, because they were accustomed to using them. However, a study among university students from Puducherry, India reported that women showed more awareness regarding health effects of plastic bags and implementation of plastic ban and women were more willing to adopt pro-environmental practices than men (16).

About 77.8% of the participants used to discard their plastic waste in open space before the plastic ban, the proportion of which has now declined to 60.6%. Other studies have shown that 40% to 60% of people used to throw plastic bags in open spaces (9, 11, 17). The higher litter rate in this study before the plastic ban could be due to lack of awareness about the hazards of plastic bags compared to other studies on issues like non-biodegradable nature of plastic bags.

In this study, 71% of the participants' reused plastic bags prior to the ban, but this number fell to 64.8% after the ban, which could be due to the fact that less reusable plastic bags were available as a consequence of proper implementation of ban. However, other studies showed that just 20% of consumers used reusable bags while shopping (4, 18, 19).

Around half of the participants in the current study were aware that plastics health risks. A study conducted in urban region of Maharashtra, India revealed that 86.44% of participants were aware of health risks (20). This difference could be due to the geographical differences (urban and rural) in both studies. Despite the fact that most participants were aware of the dangers of using plastic bags, barely 40% were aware of and used eco-friendly alternatives for plastics. These findings are consistent with previous studies (10).

This study is the first pre- and post-study carried out in India to evaluate KAP and efficient law implementation. The limitation of the study is that results are not generalizable, since it was restricted to rural region of Puducherry, South India. Another limitation is the post-ban survey which was conducted immediately after a month of plastic ban implementation rather than providing a longer washout period.

## Conclusion

Most subjects were aware of the health risks associated with the use of plastic bags and were in favour of plastic ban. However, practices regarding the use of alternative bags or reusable plastic bags were substandard. The results of this study will be valuable in designing IEC strategies for successful law implementation and in planning future demands, which will help reduce plastic consumption.

## Acknowledgement

This study was approved by both IRC and IEC

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## Conflicts of interest

Authors declare that there is no conflict of interest.

## Authors' contribution

D. K; contributed in concept, design, analysis, manuscript preparation, editing, review, and overall supervision in conducting this study, S. A and L. C; contributed in literature search, data collection, analysis, manuscript preparation and review.

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