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Research Article

BEFORE AND AFTER COMPARISON STUDY ON SINGLE-USE PLASTIC BAN IMPLEMENTATION AMONG URBAN COMMUNITY RESIDENTS IN PUDUCHERRY, SOUTH INDIA

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ABSTRACT

Objective: Plastic industry is rapidly growing industries in India. To assess the knowledge, attitude, and practice of plastic usage before and after plastic ban in urban Puducherry.

Methods: A community-based, non-randomized control trial (before and after comparison study) was conducted from May to October 2019 (6 months) at an urban field practice area of a Government Medical College in Puducherry. The study population were community residents aged above 18 years from the selected wards of urban field practice areas. The systematic random sampling was employed to cover 450 community residents. Data were collected by face-to-face interview into a pre-tested, semi-structured questionnaire. The pre-ban data collection was completed in July 2019. Ban on single-use plastics was implemented in Puducherry by August 1, 2019. After 1 month of ban (wash-out period), post-ban data collection was done among the same residents during September 2019. Data were captured using epi-collect and analyzed using the SPSS 16. Ethical clearance was obtained from the Institutional Ethics Committee.

Results: Mean age of study participants was 39.64 (13.23) years, of which 255 (56.7%) of them were females. The median income of the respondents was 16000 (25000). Before ban 403 (89.6%) were carrying their shopping items or products using plastic bags provided by the shopkeeper whereas post-ban, it has reduced to 102 (22.7%). Mean KAP (knowledge, attitude, and practice) scores before ban was 9±3.8 (95% CI 6.6–9.2), and after ban, mean scores increased to 17.2±1.5 (95% CI 16.2–18.4). A pair t-test was done between the pre- and post- ban KAP scores and was found to be statistically significant (p=0.000).

Conclusion: Most participants were aware of both environmental and health hazards from plastics and supported the single-use plastics ban.

Keywords: Plastic ban, Community-based study, Urban, Non-randomized trial.

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INTRODUCTION

In the South Asian region, plastic represents the third highest proportion of municipal solid waste.it is significant since poor management of such solid waste can contribute to fall in the quality of air, water, and soil [1]. The most appropriate intervention to reduce such waste will be by targeting a change in the consumption behaviour [2]. Plastics are highly preferred as they are light, durable, resistant, durable, cheap, and affordable, benefitting individuals but placing a burden on an entire society when it comes to their disposal [3,4]. Further, single-use plastics are in vogue but pose an environmental threat, when it comes to the nature and duration of decomposition. With respect to duration, they may take 100–1000 years to decompose, and most are non-biodegradable, breaking into smaller particles called micro plastics which may contaminate water or soil and cause many environmental and health hazards. Burning of plastics may contaminate air by releasing harmful gases into the air. Cost of plastic right from production to decomposition is huge and only 9% of plastic ever produced has been recycled; the rest cumulatively continues to pollute the environment. They cause physical nuisance such as choking drains and contribute to mosquito menace by even acting as breeding ground for mosquitoes [5,6], harm food by releasing certain chemicals if used to package hot edibles for example, styrene, a known carcinogen, Phthalates and Bisphenol which causes diabetes, heart, and liver diseases [7]. Therefore, it is imperative to turn to healthier alternatives.

To curb plastic waste, Government of India has formulated the Plastic Waste Management Amendment Rules (2021). Accordingly, the permitted thickness of plastic bags will be increased to 75 μ from 50 μ from September 30, 2021 and furthered to 120 μ from December 31, 2022. It also encourages the 4Rs: Reduce, Reuse, Recycle, and Recover [8,9].

Since the ban in Puducherry is recent compared to its neighboring states, it is of crucial importance to understand the consumer's knowledge, attitude, and practice regarding the plastics usage and their opinion on banning policy of the government. Most of research evidence on plastics usage is from developed countries [5,10]. There is dearth of information in developing countries like India. The current study mainly focuses on the consumers so that the results will be helpful planning future needs and awareness generation strategies for effective implementation of law which would help reduce the consumption of plastic in future. With this background, this community-based study, non-randomized controlled trial was done with the aims to assess the knowledge, attitude, practice of plastic usage before and after plastic ban in Puducherry.

METHODS

A community-based, non-randomized control trial (before and after comparison study) was conducted from May to October 2019 (6 months) at an urban field practice area of a Government Medical College in Puducherry. The study population were community residents aged above 18 years from the selected wards of urban field practice areas under a Government Medical College and hospital in Puducherry. Community people who were not permanent residents of the study area, individuals who were not available even after three household visits, and unstable or terminally ill-patients and known

cases of major psychiatric disorders were excluded from the study. Considering prevalence(p) as 40% from the previous literature [11], absolute precision as 5%, and non-response rate as 10% in calculating sample size using the formula recommended in the "WHO Manual for sample size determination in health studies-1999" [12].

$$n = \frac{Z(1-\alpha)^2 pq}{d^2}$$

The estimated minimum required sample size was 423 which was rounded to 430. The list of households in the field practice area was taken as the sampling frame, using systematic random sampling every 189th household was included in the study. An adult participant (preferably head of the family) in the selected household was interviewed. A pre-tested, face-validated, semi-structured questionnaire was used for face-to-face interview. The study tool comprised of two parts with questions related to socio-demographic details in Part I; Knowledge, attitude, and practice toward the usage of single-plastics in part II. The pre-ban data collection was completed in July 2019 and the single-use plastic ban was implemented in Puducherry on August 1, 2019 [13]. After 1 month of ban (wash-out period), post-ban data collection was done among the same residents during September 2019. Data were captured using epi-collect and analyzed using the SPSS 16. Quantitative variables will be summarized as mean (standard deviation) or median (IQR) and qualitative variables as percentages and proportions. Test of significance such as Chi-square test and paired t-test was done. $p<0.05$ is considered as statistically significant. Ethical clearance was obtained from the Institutional Ethics Committee before the commencement of the study.

RESULTS

The mean age of study participants was 39.64 (13.23) years, of which 255 (56.7%) of them were females. The median income of the respondents was found to be 16000 (25000). Number of family members were four in 129 (28.7%) of the households in the study area and three in 113 (25.1%). Most 402 (89.3%) of the houses in the study area were pucca hoses. The sociodemographic description of the study participants is given in Table 1.

Before ban, 403 (89.6%) were carrying their shopping items or products using plastic bags provided by the shopkeeper, whereas after ban implementation, it has been reduced to 102 (22.7%). Before single-use plastic ban, only 341 (75.8%) individuals were aware about the negative consequences of plastic usage, whereas after the implementation of the ban, it has been increased to 341 (79.3%). Easy availability 255 (56.8%) followed by low cost 118 (26.2%) was found to be the most common cause of single-use plastic usage. Out of 450 respondents, nearly 416 (92.4%) aware about the single-use plastic ban. However, only 165 (36.7%) were in favor of the ban. The most challenging factors for single-use plastic ban stated by the residents were cost-effective and easily available alternatives by 274 (60.9%) and lack of proper enforcement of the ban by 176 (39.1%). The best alternatives to single-use plastic bags as per the respondents were 217 (48%) jute bags, 201 (45%) cloth bags, and 32 (7.1%) paper bags which is depicted in Fig. 1. Age, gender, educational status, and occupation significantly (p=0.01) influenced their perception on the legislation of prohibiting consumption of single-use plastics among the study participants (Table 2).

Mean KAP (knowledge, attitude, and practice) scores before ban was 9±3.8 (95% CI 6.6–9.2). However, after ban mean scores increased to 17.2±1.5 (95% CI 16.2–18.4). A pair t-test was done between the pre- and post-ban KAP scores, the difference was statistically significant ($p<0.05$) (Table 3).

DISCUSSION

The present study shows high proportion of the study subjects (95.1%) were aware of at least one health hazard arising from plastic use, an observation better than that reported in other studies both from India and abroad where only 50–81.1% of the participants were aware of associated health hazards [7,14-16]. The most common reason reported for favoring the use of plastic bags in our study was insufficient alternatives for plastics followed by easy availability of plastics. This was similar to the observation in a study done in Delhi where the most common reason reported was convenience for shopping [15] while a study from Ethiopia reported its cheap price, ready availability and light weight as main reasons [16].

Nearly 56% of the participants reported easy availability of plastics was the reason for usage. Hence, ensuring availability of suitable and affordable alternatives like cloth bags, jute bags or even paper bags at a subsidized rate in markets would improve the practice of switching from plastic in case the consumer forgets to get one from home. This strategy was effective in reducing plastic utilization by 90% and 49% in Ireland and China, respectively [10,17].

Table 1: Sociodemographic details of the study participants

Variables	n=450 (%)
Age group	
16–25	86 (19.1)
26–35	110 (24.4)
36–45	78 (17.3)
46–55	107 (23.8)
56–65	69 (15.3)
Gender	
Male	195 (43.3)
Female	255 (56.7)
Religion	
Hindu	436 (96.9)
Christian	14 (3.1)
Education	
Graduate	126 (28.0)
Higher secondary	83 (18.4)
High school	49 (10.9)
Middle school	111 (24.7)
Primary	81 (18.0)
Occupation	
Professional	63 (14.0)
Semi-professional	14 (3.1)
Clerical/shop-owner/Farmer	50 (11.1)
Skilled worker	17 (3.8)
Semi-skilled worker	48 (10.7)
Unskilled worker	64 (14.2)
Unemployed	194 (43.1)
Type of family	
Nuclear	324 (72.0)
Joint	16 (3.6)
Others	110 (24.4)

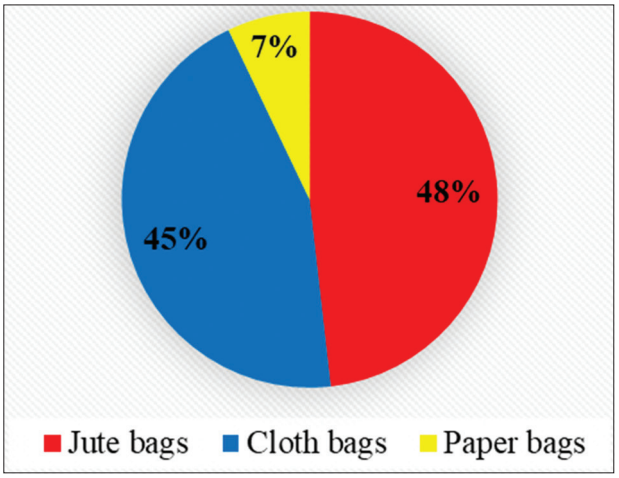

Fig. 1: Best alternatives to single-use plastic bags

Table 2: Association of perception concerning the ban on single-use plastics and socio-demographic variables (n=450)

Variables	Favoring ban (%)	Not favoring ban (%)	Total	Chi-square, p-value,
Age (in years)				
19–25	3 (16.7)	15 (83.3)	18	89.4
26–35	107 (70.4)	45 (29.6)	152	0.000*
36–45	72 (63.2)	42 (36.8)	114	
46–55	55 (39.3)	85 (60.7)	140	
56–65	9 (34.6)	17 (65.4)	26	
Gender				
Male	83 (42.6)	112 (57.4)	195	5.15
Female	82 (32.2)	173 (67.8)	255	0.023*
Educational status				
Graduate	98 (77.8)	28 (22.2)	126	162.6
Higher secondary	33 (39.8)	50 (60.2)	83	0.000*
High school	18 (36.7)	31 (63.3)	49	
Primary and middle	16 (14.4)	176 (85.6)	192	
Illiterate	0 (0)	0 (0)	0	
Occupation				
Professional/Semi-professional	49 (63.6)	28 (36.4)	77	150.9
Skilled workers	34 (50.7)	33 (49.3)	67	0.000*
Semi/Unskilled workers	0 (0)	112 (100)	112	
Housewives	82 (42.3)	112 (57.7)	194	

*p<0.05

Table 3: Comparison of knowledge, attitude and practice scores before and after plastic ban (n=450)

Variables	Pre–ban scores Mean±SD (95% CI)	Post–ban scores Mean±SD (95% CI)	p
Knowledge	4.5±1.7 (4.3–4.6)	6.5±0.66 (6.1–6.6)	0.000*
Attitude	3.99±1.1 (3.8–4)	4.5±1.1 (4.4–4.6)	0.000*
Practice	2.5±0.97 (2.4–2.6)	7.1±1.1 (7.0–7.2)	0.002*

In this study, 7.6% of the urban participants were not aware of the legislation on plastic. The shopkeepers too, unawares, provide plastic bags for their customers, irrespective of whether they need it or not. Similar observation was reported in the study at Delhi where some stores repeatedly violated the ban [4]. This brings to light the ignorance on part of both shopkeepers and consumers regarding the legislation ban. It also highpoints the ineffectiveness or low reach of awareness campaigns for spreading information on penalties for breach.

On the other hand, in China, Xing *et al*., observed that usage of plastic bags fell drastically on implementing a ban following the implementation of ban and public awareness regarding environmental protection increased [18].

In the current study, about 63% respondents were not in favor of plastic ban. They were unskilled and semi-skilled workers. Similarly, in Delhi, 76% of housewives and 53% of low-income group were those who were against the plastic ban [9]. Most of these homemakers were aware of the health hazards posed by plastic bags but preferred them due to convenience.

77.8% of the participants were disposing their plastic waste in open and barren areas before the ban and this proportion has reduced to 60.6% after implementation of the ban. This is higher than that reported by studies on Ethiopia (59.6%), Rajasthan, India (40%) and Tamil Nadu, India (43.1%) who litter plastic bags in open areas [11,16,19]. The higher litter rate in this study before the plastic ban could be because of lack of awareness on plastic related health and environmental dangers and issues like non-biodegradability.

In this study, pre-ban reuse of plastic was 71% which diminished to 64.8% post-ban. Other studies from California, USA revealed only 18.9% participants were reusing bags. In another study done in Delhi and Mangalore city [15] only 4.6% and 20% of participants carried their own plastic bags for shopping [14,15,20].

Although, most consumers were aware of the plastic borne hazards, only 40% in the present study were cognizant of eco-friendly bags and very negligible percentage were using them.

The best alternatives to single-use plastic bags as per the respondents were 217 (48%) jute bags, 201 (45%) cloth bags and 32 (7.1%) paper bags. Note should be taken however, that it is still controversial whether paper bags could be considered an affordable, eco-friendly alternative to plastic. Although paper bags degrade much quicker in the environment, they require more energy to be produced, are more expensive and once discarded take more space in collection trucks and landfills. IEC (Information, Education, and Communication) materials can be distributed to inform citizens about available alternatives. On the island of Guanaja (Honduras), each household was provided with information through a door-to-door campaign and in addition, each household was given two canvas reusable bags [6].

Strengths and limitations

This study stands as first before and after comparison study to be conducted in Puducherry immediately after single-use plastic ban enforcement for assessing the knowledge, attitude, practice, and also for assessing the effective implementation of the ban.

CONCLUSION

Most of the participants in the study area had the awareness of environmental and health hazards from single-use plastic products and supported in banning the same. However, practice of reusing already used plastic bags or using better alternatives was poor among majority of the participants. Creating awareness on these strategies and effective implementation of legislation will contribute to diminution in the usage of single-use plastics in the city. The respondents observed the enforcement of the ban as for their own betterment and so therefore believed it is their responsibility to co-operate with the government to reduce the use of single-plastics.

AUTHOR'S CONTRIBUTION

Dr Devi. K conceived the idea and concepts, planned this study, reviewed the draft, finalized and approved the final version of manuscript. Dr. Lalithambigai and Dr. Sivapushani. A prepared the literature search, collected data, analyzed data, and prepared the initial draft.

CONFLICTS OF INTEREST

None.

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