

Original Research Article

## Survey on Plastic Usage among the Teenagers of Alappuzha Town, Kerala

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**Abstract:** The survey was done to analyze the usage of plastic among the teenagers of Alappuzha town. College and school students as well as some of their neighbours were selected as the sample population. The sample population belonged to three age groups i.e. 15 -17, 19-21 and 40-50, majority being teenagers i.e. the first two groups, comprising 91% of the total population. It is evident from the survey that without stringent control measures/ban from the side of government, the unhealthy usage of plastic as well as the pollution of environment by plastic waste would increase alarmingly. Though 73.5% of the surveyed subjects are of the opinion that plastic should be completely banned and 77% say they are ready to be involved in an initiative against plastic pollution, 92% disagree to carry a plastic bag in hand to shop so that it could be reused to maximum, 37% still prefer to use plastic carry bags instead of cloth/paper bags, 42% has adopted burning as a method of disposing plastic carry bags, 14% use more than six plastic carry bags each day, and 75% carry drinking water in plastic bottles. 51% of the people had never heard about Bisphenol A, a chemical that leaks from plastic. Survey shows that awareness given though education is not enough to equip students to take deterrent actions that favour the conservation of the environment instead of favouring ones comfort and convenience.

**Keywords:** Survey, plastic, Bisphenol A, Alappuzha, plastic carry bags

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### INTRODUCTION

Plastic pollution has become a global problem that an incredible number of research is being carried out to study the effects it is causing on living organisms. Anything which is excess in nature should be removed to maintain its subtle balance. This theory is seen in any ecosystem that we analyse closely. Plastic being non biodegradable cannot be removed from earth and the detrimental effects that we see may be one of the nature's mechanisms to restore balance. Recent research has shown that the alarming use of plastic has not only increased the amount of waste but it is also leading to various life threatening changes in the physiology of living organisms exposed to the chemicals leaking from them.

It was after World War I, the mass production of plastics started [1]. The first created polymers were polystyrene and polyvinyl chloride [2]. The review cited by Eriksen *et. al.*, [3] in marine pollution bulletin gives a clear picture of the rate of increase in piling up of plastics in marine environment. According to Eriksen's findings plastic pollution is the dominant type of anthropogenic debris ubiquitous throughout the marine environment. Floating plastic fragments have been reported in the Northern Hemisphere subtropical gyres since the early 1970s in the North Atlantic and

North Pacific. Few data exists describing plastic pollution in the Southern Hemisphere subtropical gyres although 81% of the earth's surface south of the equator is seawater. Plastic pollution, originating from sea- and land-based sources, migrates into subtropical gyres where it forms accumulation zones of micro plastic particles distinct from surrounding waters relatively free of plastic pollution. Plastic pollution enters the marine environment via rivers, beaches, maritime activities, and illegal dumping at sea. Under the effects of UV degradation and hydrolysis, plastic loses its elasticity, and powered by wind and waves, gradually breaks into smaller particles. Surveys in the south-eastern South Pacific Ocean identified sea based activities such as mussel culture and aquaculture as the most significant contributor of floating marine debris [4]. In a survey of waters near Antarctica, plastic pollution was the only type of marine debris found south of 63°S [5]. In the study of plastic pollution in the South Pacific subtropical gyre shows that the average abundance and mass was 26,898 particles per km<sup>2</sup> and 70.96 g per km<sup>2</sup> respectively [3].

An overview of the deleterious effects of plastic debris can be made out from the work of Derraik, 2002. A large number of marine species is known to be harmed and killed by plastic debris.

Marine animals are mostly affected through entanglement in and ingestion of plastic litter. To address the problem of plastic debris in the oceans is a difficult task [6]. 30 million tons of plastics were produced in U.S. alone in 1988. Plastics are lightweight, strong, durable and cheap [7]. These characteristics make them suitable for the manufacture of a very wide range of products. These same properties make them a serious hazard to the environment [7, 8]. Since they are light weight and buoyant, the plastic debris can be dispersed over long distances and settle in sediments where they persist for centuries [6]. From the list of places showing the proportion of plastics among marine debris worldwide (per number of items) by Derraik, 2002 it can be inferred that Bay of Biscay in NE Atlantic Seabed, South African beaches and Cape Cod in USA scores more than 90 and the list does not mention any places in India. The less conspicuous small plastic pellets and granules are a threat to marine biota. They are found in large quantities on beaches and are the raw material for the manufacture of plastic products that end up in the marine environment through accidental spillage during transport and handling, not as litter or waste as other forms of plastics. Their sizes usually vary from 2–6 mm, though occasionally much larger ones can be found [6]. The chemicals that leach from plastic, the process which is accelerated and influenced by increasing temperature and the presence of other chemicals lead to health hazards such as cancers, birth defects, impaired immunity, endocrine disruption, developmental and reproductive defects etc. [6]. In the survey conducted among 230 randomly selected respondents in the Jimma City of Ethiopia it was found that the most commonly used plastic item was plastic bags that around 76.5% came in the category regardless of age, occupation, economic and educational status. And among them 59.5% practised open dumping into surrounding areas [9].

Majority of the global statistical studies on plastic waste accumulation does not list places from India and this may be due to the inadequate resources and studies on plastic pollution in this country. Very few studies on plastic waste accumulation has been found in connection with places in India at a global scale, like the studies of the currents of Bay of Bengal that render momentum to the movement of plastic waste belts in the ocean [10]. And the studies are gaining momentum because of the increased awareness on plastic waste accumulation and its negative effects.

In India, Government agencies as well as various NGOs are involved in instituting rules and regulations to control the use of plastic such as Pollution Control Board, Bureau of Indian Standards (BIS), Recycled Plastics Manufacture and Usage Rules, 1999, Plastic Waste Management and Handling Rules, 2011 [11]. Tamil Nadu Pollution Control Board (TNPCB) has taken action to mitigate the non reusable plastic waste by co-processing at cement kilns. Reliance

Industries (RIL) in partnership with Gujarat Engineering Research Institute (GERI) constructed a 900 meter road stretch using 5% plastic waste. Non recyclable plastic waste used in construction of tar road reduced construction cost and improved road life [11].

The investigation carried out by the Central Pollution Control Board (CPCB) of India in three railway stations and two airports in Delhi envisages that 6758 kg/day and 3662 kg/day of plastic waste is generated respectively. The per capita plastic waste generation is approximately 9 gm/day at railway station and 69 gm/day at airport, which is many times higher than railways. Non recyclable plastic items were left behind in the area and the value added plastic waste was collected by informal sectors [12]. In India plastic industry employs around 4 million people. More than 30,000 processing units function here of which 85 to 90 percent are small and medium enterprises. Around 35 percentage of plastic consumption is made by the packaging section which is the single largest sector of plastic use. Authentic figure for plastic generation in India is not yet available but it is estimated as approximately 5.6 million tonnes per annum which is about 15,342 tonnes per day [13]. Although several rules, regulations, restrictions and bans are declared by government and NGOs, the effectiveness of the measures prove to be doubtful [13]. In India, the per capita plastic products consumption when compared to other countries is much lower. While the per capita plastic products consumption is 109 kg/person in USA, 65 in Europe, 45 in China and 32 in Brazil, it has reached only 9.7 kg/person in India [14]. The application of plastic in agriculture and food processing is increasing day by day [14].

Currently in India there are approximately 3500 organized recycling units for plastics and around 4000 unorganized recycling units. Dumping of waste in open areas and streets without segregating it will reduce its quality and make the plastic waste hazardous. Plastics used in packaging and one time use plastics such as cups and plates, the so called paper cups and plates may have a thin coating of plastic and create waste management problems since the discarded materials are not disposed properly [14].

Decades of research has allowed scientists to link Bisphenol A (BPA), a substance used to harden plastic with endocrine disruption, problems with brain and reproductive development, early puberty, rise in breast and prostate cancer. This has led to the manufacture of BPA free plastic items by finding alternatives for it. CNN reports that the BPA-free plastic alternatives are not safe as the majority believes. Most often Bisphenol S (BPS) is replaced instead of BPA and the recent studies in Zebra fish shows that it has the very similar effects as BPA [15].

**METERIAL AND METHODS**

The survey was done among the students of St. Joseph’s College for Women located in Alappuzha town area, students of Chinmaya Vidyalaya Alappuzha and among the parents and relatives of the students surveyed. This will make up a population of random samples from the people of Alappuzha town, around 91% being the teenagers. A total of 450 people were surveyed. It included three age groups, 15-17, 19-21 and 40-50. A questionnaire was prepared which includes several questions, mostly related to the uses of plastic and how they depose it. Personal interactions were also made with some people. The data collected from questionnaire and personal investigation were subjected to statistical analysis.

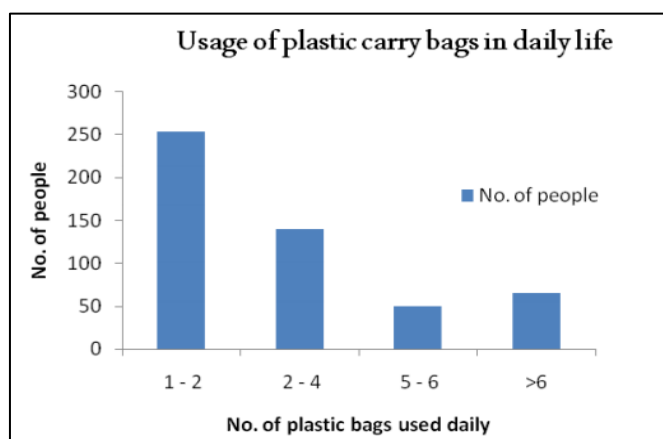
**RESULTS AND DISCUSSION**

The survey was carried out among 450 individuals. The survey includes three age groups - 15-17, 19-21 & 40-50. 102 people coming in the first age group, 308 people belonging to second age group and 40 people belong to third age group was surveyed.

Of the total people surveyed, 97% agree that they are aware about India’s excessive use of plastic. 92% of the surveyed people strongly disagree to carry a plastic bag to the shopping area with them while shopping. The average number of plastic bags used per day by people surveyed is given in table 1. Around 14% are using more than 6 plastic bags per day (Fig 1).

**Table 1: Average number of plastic bags used by people in their daily life**

Average number of plastic bags used	No. of people	%
1 – 2	254	56
2 – 4	140	31
5 – 6	50	13
>6	65	14



**Fig-1: Average number of plastic bags used by people in their daily life**

Of the total people surveyed, 34% prefer to use plastic bags while shopping. Only 21% and 37% prefer to use paper bags and cloth bags respectively (Fig 2). If different age groups are analysed, among the third age group no one prefers to use plastic bags. While among

the first age group 89% prefer to use cloth bags and only 4% said they require plastic bags. Among the second age group 50% prefer to use plastic carry bags for various purposes.



**Fig-2: Preference of the surveyed subjects for different types of bags for shopping**

About 13% of the surveyed population do not burn plastic items. But a major percentage i.e. 66% rarely burn plastic items and 21% always burn plastic

items as a means of disposing it. The disposal method adopted for plastic carry bags by 42% of the surveyed population is by burning it (Fig. 3).

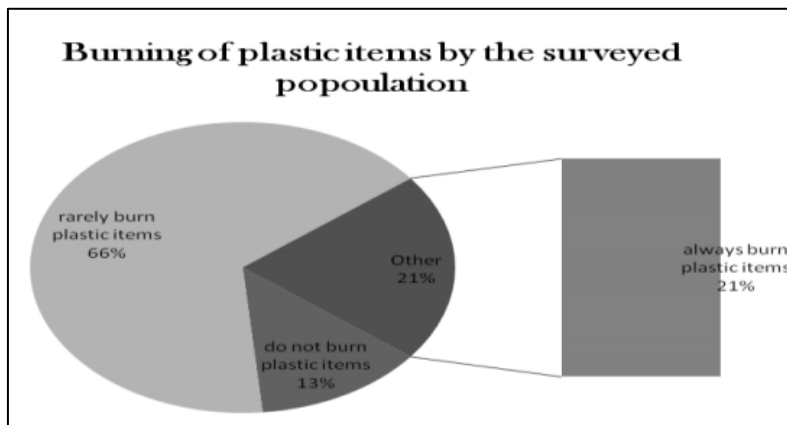


Fig-3: Burning of plastic items by the people surveyed

Table 2: Commonly used plastic item by surveyed population

Items	No. of people
Plastic Bags	40
Plastic Cups	45
Plastic Bottles	231
Packaging	122
Others	12

67% of the total surveyed population said that they use less plastic in their life than 5 years ago. But among the third age group 57% said that they use more plastic bags items than 5 years ago. 82% of the total people surveyed said that they use plastic furniture and toys at home. 43% of the surveyed population said that

they use plastic shoes and jewellery. The most commonly used plastic item as per the opinion of surveyed subjects are given in table 2. 51% say that they use plastic bottles the most and 27% use it the most for packing (Fig. 4).

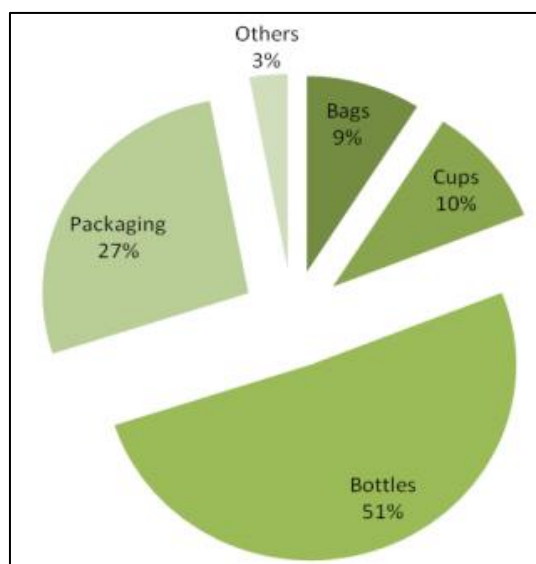


Fig-4: Commonly used plastic item by surveyed subjects

Among 450 people surveyed 96% agree that they have heard or read about the dangers of plastic usage and only 4 % are not aware about its dangerous effects. 67% of people said that their source of

information about dangers of plastic is from TV, Radio and Newspapers. 40% of surveyed people are of the opinion that the society requires more awareness about

the dangers of plastic bags while 50% said that the society has enough information about plastic.

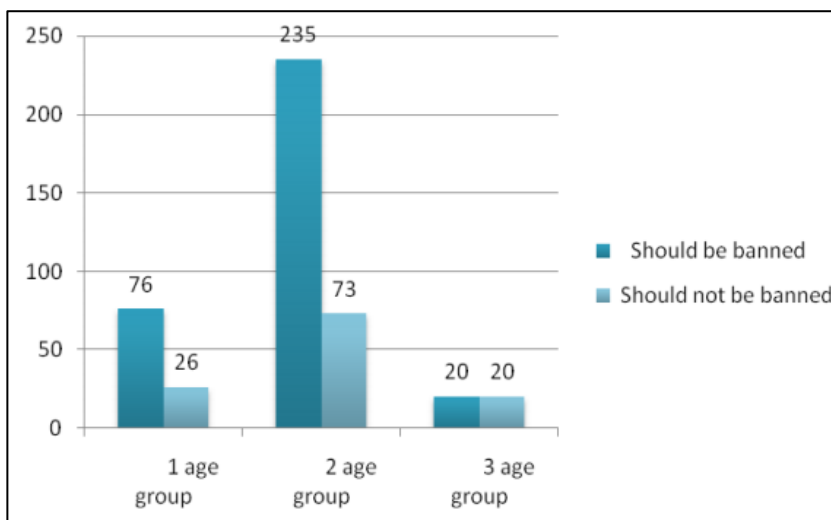
Among the 450 surveyed 99% are ready to support the efforts to reduce consumption of plastic bags and among them, 93% strongly believe that they can reduce the rate of consumption of plastic bags if given proper guidance, support and sufficient substitute for plastic such as paper and cloth carry bags. 100% of the third and first age groups are ready to support the efforts and in the second age group 98% are ready to support the efforts. It was found that 21% believe that government is poor in giving awareness to society about plastic while 50% said that government initiatives is acceptable. 8% are satisfied with the works done by government and they said that government is excellent at their works. 46% of people like to have a free plastic bag which is degradable while in a supermarket. 35% among the 450 expressed their readiness to carry eco bag even if they have to pay for it. 20% prefer ordinary free plastic carrier bag. Among the first and third age group more people prefer to take free degradable plastic bags i.e. 81% and 62% respectively if provided. While in the second group 42% are ready to carry eco bags. Of the total surveyed 16% do not reuse plastic bags, 33% use it only once, 29% use it for 2-5 times, only 18% use

it for more than five times and 54% reuse it for other purposes such as shopping, as bin liner and also for other purpose. Among the 450, 63% people think that government should ban the use of plastic bags so that its use can be reduced. The survey shows that 100% of the third age group support the ban.

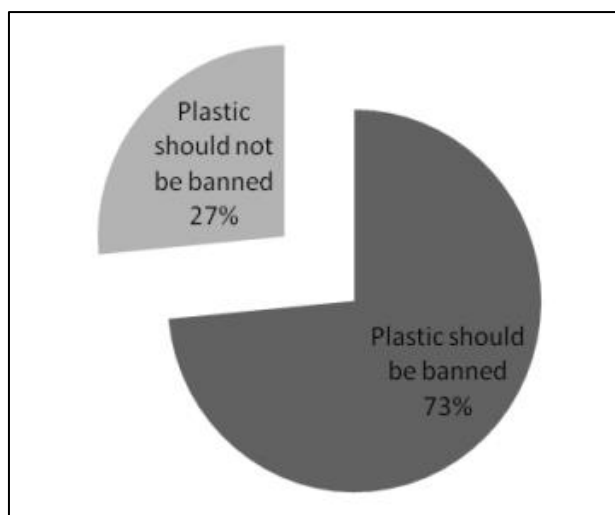
45% said that charging of plastic bags is a good idea to reduce the use of plastic bags, while 30% doesn't like that idea. 65% among the surveyed population said that plastic bags lie or float around for decade, so that plastic bags are harmful for the environment. The most common plastic item used by the surveyed population is bottles i.e. 51% use plastic bottles. 19% most commonly use plastic bags and cups and 27% use plastic for packaging. After first usage 31% put the plastic items in dustbin and 23% burn it. 27% said that they recycle it. 19% reuse or sell the plastic items. 88% are aware about the environmental effects plastics are carrying in the world while only 4% are taking action towards reducing its use. 77% like to be involved in an initiative against plastic use while 23% are not interested in it. 73.5% said that plastic should be completely banned (fig.6). The opinion of different age groups on ban is given in table 3.

**Table 3: No. of people in different age groups who supports and oppose a ban on plastic**

Age group	Total no. of people	Should be banned	Should not be banned
1 age group (15-17)	102	76	26
2 age group (18-21)	308	235	73
3 age group (40-50)	40	20	20



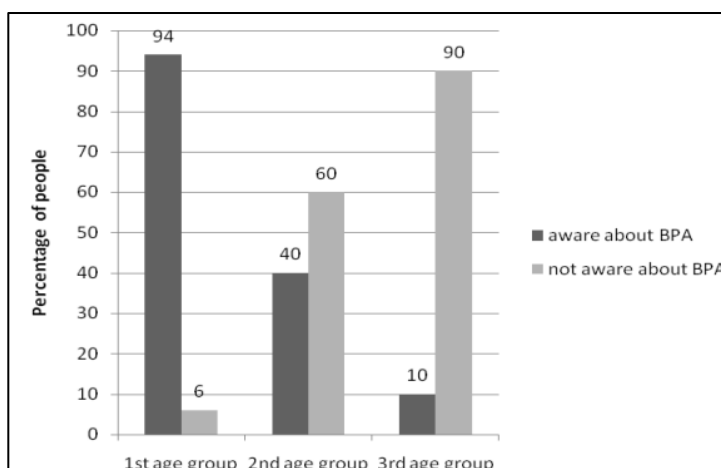
**Fig-5: Number of people in different age groups who supports and opposes a ban on plastic**



**Fig-6: Opinion regarding ban on plastic by the total population surveyed**

Among the 450, 51% have never heard about the chemical Bisphenol A which leaks from plastic items causing various detrimental effects on living organisms. While analysing age wise, among the 1<sup>st</sup> age

group 94% and in the 2<sup>nd</sup> age group 40% are aware about Bisphenol A. As shown in figure 7, in the 3<sup>rd</sup> age group, a major percentage (90%) is not aware about Bisphenol A.



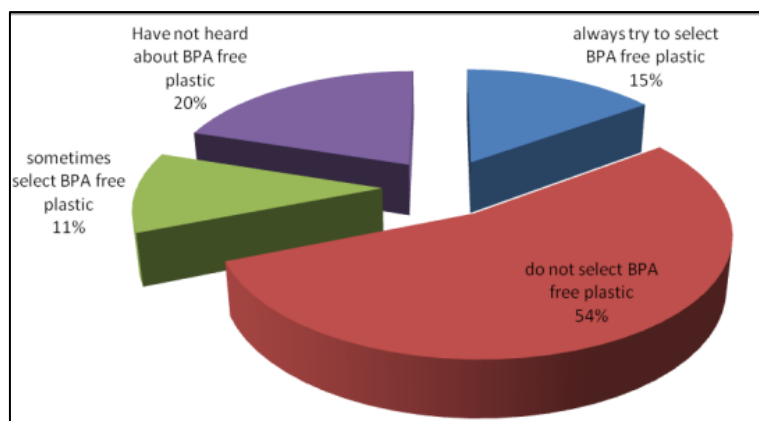
**Fig-7: Awareness of surveyed people about Bisphenol A**

Around 69% of the surveyed population are not aware about the fact that Bisphenol A leak from plastic items when it comes in contact with hot liquids. 54% said that they are not in practice of selecting

Bisphenol A free plastic items (table 4). 11% said that sometimes they select Bisphenol A free plastic items. 15% always try to select Bisphenol A free plastic items (fig. 8).

**Table 4: People who select BPA free plastic**

Selecting BPA free plastic	No. of people	%
Always try to select	67	15
Never select	243	54
Sometimes	50	11
Have not heard of BPA free plastic	90	20



**Fig-8: Selection of BPA free plastic**

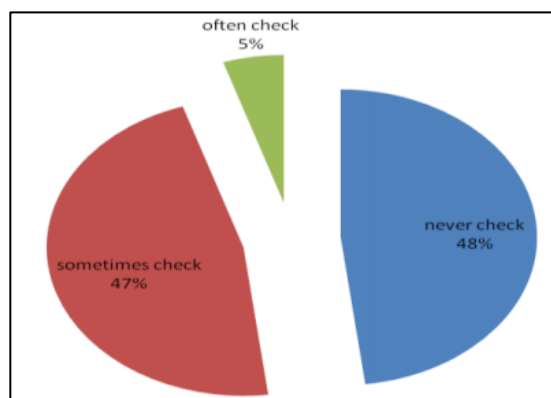
75% use plastic bottles to carry drinking water. Only 6% carry Bisphenol A free plastic bottles and 13% carry water in steel bottles. 41% of surveyed individuals said that they store drinking water in plastic bottles at their home, while 14% said that they store it in glass containers. 27% store water in steel containers and 5% store water in Bisphenol A free containers. 48.2% carries hot food items in plastic containers. Only 3%

said that they had never carried hot food items in plastic containers and the rest do it according to their convenience.

Only 5% of the surveyed population often check the identification code number of the plastic items that they purchase (Table 5 and Fig 9).

**Table 5: Checking the grade number of plastic items before purchasing**

Checking identification code	No. of people
Often check the code	21
Sometimes check the code	218
Never check the code	219



**Fig-9: Checking the identification code of plastic items before purchasing**

68% of the surveyed subjects are not aware about the fact that BPA which leaks from plastic has the capacity to cause hormonal imbalances in living organisms. It was found that majority of the subjects

coming under first age group and a fairly good number of subjects coming under the second age group are aware about this fact as shown in table 6.

**Table 6: Awareness of the surveyed subjects on the hormonal imbalance caused by BPA**

Age group	Yes	%	No	%
15 – 17	96		6	
19 – 21	47		261	
40 – 50	2		38	
Total	145	32	305	68

Although 97% agree that they are aware about India’s excessive usage of plastic and the dangers of the

piling plastic waste, 92% strongly disagree to carry a plastic bag with them for purchasing instead of taking

plastic kits from the shopkeeper at each purchase. This is the root cause of the accumulation of plastic bags and kits in our surrounding environment, in the land and water [12, 13]. 13% of the surveyed population say that they use more than six plastic bags/kits each day. This attitude of the people make it very difficult to control use of plastic which leads to increasing plastic pollution of the environment without stringent measures from the side of Government [14]. Several values obtained through survey shows that giving awareness influence only a very small percentage of the population since 91% of the subjects surveyed belong to age group who is being well informed and thus only through enforcement of strict laws that the excessive use of plastic could be controlled. Figure 2 shows the preference of the surveyed subjects for different types of carry bags for shopping. Only 37% prefer to use plastic carry bags for shopping, the rest preferring paper/cloth carry bags, but various other results show that their preference differ greatly from what they actually do.

Although using plastic at their convenience and 73.5% suggested that a complete ban on plastic could reduce the plastic use so that plastic pollution could be controlled. A ban on plastic carry bags would force the people to bring their own paper/cloth carry bags to shop during shopping. The accumulation of plastic items mainly carry bags can lead health problems in living organisms including death of aquatic and terrestrial organisms [6, 7, 16]. Several organisms consume thin plastic bags, as well as other plastic materials which cause problems in digestion which eventually lead to their death. Several aquatic organisms also consume plastic items which cause digestion problems. Entanglement in plastic materials can also lead to death of several organisms [6]. Other than digestion problems and entanglement, BPA that leaks from plastic is an endocrine disruptor which causes hormonal problems in organisms [17, 18]. The open disposal of plastic items may clog drainage systems and lead to growth of mosquitoes and other vectors which may spread diseases [19]. Pelagic plastic debris acts as a vector for the dispersal of harmful microalgae [20].

When plastic containing BPA comes into contact with hot liquids, it leads to the leakage of this chemical from the plastic. This can happen at lower level when plastic come in contact with liquids of normal temperature but is aggravated by the increase of the temperature of the liquid and by the age of the plastic item as well as by brushing to other surfaces [21]. In survey it was found that 75% use plastic bottles to carry drinking water and 35% even carry hot water in the plastic bottle. People may be doing this for their convenience, easy availability of plastic bottles and because of the ignorance about leakage of BPA and the negative effects this chemical can cause in the body. It was found that 51% has never heard of the chemical

BPA, 69% are not aware that BPA can leak from the plastic and 68% never know that BPA can cause hormonal imbalance. If this is the case with a survey done with majority of the people i.e. 91% belonging to the age groups 15-17 and 19-21, who are well literate and informed, the value of above said results may increase if sample size is extended to general public.

The identification code on plastic items is used to identify the plastic resin from which the item was made and thus indicates the quality and composition of plastic item. Identification codes are mainly used for recycling purpose. (plastic industry. org). Plastics with identification code 1, 2, 4, 5 and plastics labelled 'phthalate-free' or 'BPA-free' are generally considered safe to use (nrckids.org). The survey shows that majority are unaware about this fact. Only 5% are in the practice of checking the identification code number of the plastic items they buy. This may be due to the lack of awareness among the people regarding the code number of plastic items which indicate the composition of various chemicals in plastic items. Most plastic bottles show only the number that indicates the grade of the plastic used for its manufacture rather than the chemicals it is composed of. Only those industries who aim people seeking for BPA free bottles indicate on the label that it is Bisphenol free. But the recent finding is that the chemicals which replace BPA in plastics are not actually safe to use [15].

Survey shows that 21% of the surveyed people always burn plastic items and 42% has adopted burning as a disposal method for plastic carry bags. Despite of the education that the students have received, burning of the plastic items continues and this shows that more awareness should be provided in schools and colleges regarding the disposal of plastics. Burning of plastics can release noxious gases into the atmosphere such as carbon monoxide, furans, dioxins [22] which can lead to health problems such as respiratory diseases, cancer, reproductive and endocrine system effects [23].

Polythene when burnt release major harmful green house gases into the atmosphere [24]. Also it seems that majority of the sampled population are unaware about the ban on unregulated open burning of plastic, rubber or such other article across the country declared by National Green Tribunal, New Delhi [25].

It was found that 94% of the people in 1<sup>st</sup> age group are aware about Bisphenol A. These are students undergoing plus two courses. Only 40% of the college students are aware about it and in third age group only 10% have heard of the chemical BPA. When the whole population is considered, 69% are not aware about the fact that BPA and many other chemicals can leak from plastic materials [26]. This may be contributing factor of using plastic boxes and bottles to carry food and water. Increasing incidence of hormonal imbalances can be related to the increased usage of plastic materials to



carry food and water. BPA is a chemical with estrogenic activity which has proved to cause various endocrine problems in various organisms [26], majority of the studies being done in fishes.

## CONCLUSION

The survey shows that awareness given through education is not enough to equip students to take deterrent actions that favour the conservation of the environment instead of favouring ones comfort and convenience. Stringent control measures should be taken by governing bodies in the form of fine, penalty or ban, in order to control the excessive usage of plastic materials.

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