ORIGINAL ARTICLE

Knowledge, Perception and Practice Towards Microplastic Contamination in Human Body among Community in Ampang, Selangor and the Associated Sociodemographic Factors

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ABSTRACT

Introduction: Microplastic pollution in the environment has already been visible for years, yet exposure and risks to humans were underexplored. Human's risk perception regarding microplastic contamination was overlooked although a new study proved that microplastics existed in human blood. This study aimed to investigate the level of knowledge, perception, and practice towards microplastic contamination in human body and the associated sociodemographic factors among community in Ampang, Selangor. **Methods:** An observational analytic with cross-sectional study was conducted. Malaysian residents aged 18 and above were recruited by cluster sampling method. A validated and pretested self-administered questionnaire was used to obtain the sociodemographic data, knowledge, perception and practice scores of 437 respondents. Questionnaires were distributed both physically and virtually. **Results:** The studied community obtained a high level of knowledge (51.0%), positive perception (39.8%) and moderate level of practice (44.2%) regarding microplastic contamination in humans. Age, education, marital and employment status were significantly correlated with all knowledge, perception and practice ($p<0.05$). Gender was highly associated with both perception and practice while income level and family history of disease were related to practice level only ($p<0.05$). Furthermore, practice level is significantly associated with both knowledge ($X^2=115.718$, $p<0.001$) and perception ($X^2=140.850$, $p<0.001$). Among all factors, perception is the main predictor of practice where people with neutral perception having poor practice is 52.8 times greater than the odds of people with positive perception. **Conclusion:** Among all factors studied, perception is the main predictor of practice in preventing microplastic contamination in the human body.
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INTRODUCTION

Microplastics are known as tiny plastic particles that are less than 5mm (1). In the literature, microplastic is often defined as plastic particles up to 5 mm in dimensions with no defined lower size limit (2). They are also known as microfibers in clothing materials and microbeads in personal care products (sunscreen, cleansers, cosmetics). Microplastic has persistent characteristics and is hard to remove from the environment. An extensive dataset on the presence of plastic particles in different matrices has been obtained from analytical research conducted globally, including biota (gut contents) (3), air (4, 5), water (6, 7, 8), sediment (9) and foods (10, 11). Most data available are for particles larger than 10 or 50 µm while fewer studies were done for submicron sizes which have higher possibilities of contaminating internal human organs (12).

Microplastics endangered the soil environment through anthropogenic activities. For instance, irrigations, land modification, waste disposal site, road flow and atmospheric deposition (13). Once the microplastics integrate into the soil matrix, the porosity of the soil may be altered which give impacts to the water dynamics and aggregation of the soil. Besides, microplastic accumulation in the soil may affect the process of nutrient cycling in terrestrial ecosystems (14). However, research regarding microplastics and soil organisms are still less discovered (15).

Besides, microplastic pollution may cause negative impacts on marine organisms because microplastics are mostly washed out to the ocean through water disposal. Microplastic pollution in the ocean poses the risk of ingestion of the small particles by marine organisms (16). Findings reported that bioaccumulation and biomagnification of microplastics do occur in marine organisms (17,18). Literature findings also found

potential health risk of microplastic exposure to marine organisms is cytotoxicity. An in vitro study conducted by Furukuma and Fujii (19) using the colony-forming assay (CFA) identified the cytotoxicities, with IC_{50} values between 18 and 74%. Those moderate level of cytotoxicity among the samples denotes the possibility for mucosal tissue inflammation, which could adversely affect the physiological state of marine-based organisms.

Ultimately, concerns are how exposed humans are to these tiny microplastics and whether the exposure truly results in uptake within the body. Human body may be contaminated through ingestion by contaminated food and water, inhalation of suspended microplastic particles and dermal contact with contaminated soil or water (20,21). An analysis of human feces using Fourier Transform Infrared spectroscopy (FTIR) presented evidence that the gastrointestinal tract excreted the tiny plastic particles (22). Other FTIR experiment also discovered microplastics in human colectomy specimens (23). Besides, polypropylene particles sized 5-10 µm were identified in human placental tissue using Raman spectroscopy technique (24). New development on microplastic determination and quantification was successfully done in Netherlands which found microplastic particles in human blood for the first time. Hence, this human biomonitoring study indicates that plastic particles can contact humans and are bioavailable in human body (12).

Microplastics effects on humans are mainly based on animal studies and extrapolated to human (25). Experimental research on rats fed with low-density polyethylene microplastics confirmed that hippocampal neurons were significantly affected by microplastic particles in the blood (26) raising concern on similar effects to humans. Besides, microplastics may be present in additive forms such as BPAs, phthalates, heavy metals and flame retardants. These chemicals may act as endocrine-disrupting chemicals (EDCs) which are able to mimic the natural hormones and lead to pattern alteration and receptor expression modification. EDCs are linked to several health problems including reproductive problems, hormonal cancer, metabolic disorders and neurodevelopmental diseases (27). Cytotoxicity risk in the human brain and epithelial cells were also found in several in-vitro studies (28,29)

Several studies that relate microplastics effect to humans through inhalation were also discovered. Researchers from Florida State University subjected lung cells in a petri dish to low concentrations of polystyrene, which level is frequently found in the environment, and discovered some intriguing modifications. The cell metabolic system has been delayed, cell growth has been halted, the cell's shape has changed, and they become abnormal (30). Furthermore, another study reported that microplastics may be inhaled in greater concentration if the size of the particles is smaller. Microplastics with a size of less than 2.5 µm can enter the lung and able to penetrate the respiratory airway to reach the blood flow (31). Additionally, a previous study reported that inhalation of fibrous microplastic can cause cancers among factory workers (32).

Many studies are being done to quantify the amount of microplastics in Malaysia. An analysis of six polymer materials was conducted in Kuala Nerus and Kuantan to collect microplastic data in Malaysian marine waters (33). Another study done by Sarijan et al. (34) measures the occurrence of microplastic in freshwater and its impacts on marine ecosystems. It was found that the abundance of microplastics in the rivers may be due to the breakdown of big plastic items from the industrial and fishing areas. Moreover, there is a study done to quantify and characterise microplastics from cosmetic and personal care items and its emission to marine environment (35).

Nevertheless, humans' behaviour towards microplastic issue is still less discussed and progress was less shown among humans in reducing the use of microplastics in daily lives. In this term, sociodemographic factors may contribute to different risk perceptions and behaviour. Several studies compared the knowledge, perception or behaviour of different groups of people. The findings showed that there were some groups have better knowledge, perception or behaviour towards microplastic issues compared to the other groups due to their differences in life background. For instance, research comparing the perceptions of environmentalists, beauticians, and students found that the environmentalists are aware of this problem while it was the opposite for both beauticians and students (36).

To summarise, the literature showed that there are extensive studies done regarding microplastic abundance in the environment and its impacts to the marine organisms. Fewer studies were done regarding microplastics and human contamination. Most importantly, maybe none as far as we concerned in Malaysia. There is a visible gap in knowledge about microplastic contamination in human body in Malaysia. This matter should never be disregarded as the tiny particles will end up being consumed by humans. In this study, sociodemographic factors are taken into account while measuring the community's knowledge, perception and practice towards microplastic issue. The level of knowledge could be revealed to know if they are aware of microplastic existence and its effect. Besides, this study may explore the community's behaviour regarding this issue through their perception. Since each person perceives things differently, it may affect their action and practices in daily life regarding plastic pollution. Ultimately, the main predictor of practice to prevent microplastic contamination is also discussed in this study.

MATERIALS AND METHODS

An observational analytic with cross-sectional study was conducted among the community in Ampang, Selangor. Selangor consists of nine districts which are Sabak Bernam, Hulu Selangor, Kuala Selangor, Gombak, Hulu Langat, Petaling, Klang, Kuala Langat and Sepang. Based on the Department of Statistics Malaysia Official Portal (37), Selangor has 6.56 million of population of which 3.39 million are male while the remaining 3.17 million are female in 2021. Ampang was chosen to be the location of this study due to the fact that Ampang River is known to be one of the tributaries of Klang River which has been recognised as the major source of plastic waste in the ocean (38).

Sampling method

In this research, cluster sampling was used to collect the data. The population was divided into three groups which represent three territories in Ampang, Selangor which are Ampang, Hulu Kelang and Setapak. Ampang territory was randomly chosen and the respondents were drawn through convenience sampling to facilitate researcher to collect data in a short time. The sample size was calculated based on Two Proportion Formula by Lwanga & Lemeshow (39). By considering 5% of non-response, missing data, and unavailability or refusal of the subject, the calculated sample size was 437 with prevalence values of 0.134 and 0.5, which referred to the results generated by referring to a previous study by Deng et al. (40) within 5% of true prevalence with 95% confidence.

Data collection and instrumentation

Figure 1 showed the flowchart of this research. The study obtained approval from The University Ethics Committee Involving Human Subjects of Universiti Putra Malaysia, prior data collection (Reference no: JEUPM-2022-394). In this research, the community was recruited conveniently in several of locations in Ampang, Selangor. The participants were approached directly at their houses while some of them were being approached at public places like parks, stores and malls. A small number of participants were also recruited online through the residents' association of Ampang territory. The participants were asked for permission and approval first. Next, a brief description of the study, objectives, declaration of anonymity and confidentiality were given. The participants further receive a self-administered questionnaire once the inclusion criteria which are Malaysian residing in Ampang, Selangor aged 18 and above have been met. Illiterate people were excluded in this study.

The questionnaire was developed from previous studies by Cammaleri et al. (41) and Soares et al. (42) and was being modified to match this research. The questionnaire available in both hard copy and google form type since it is convenient and familiar to be used by many people.

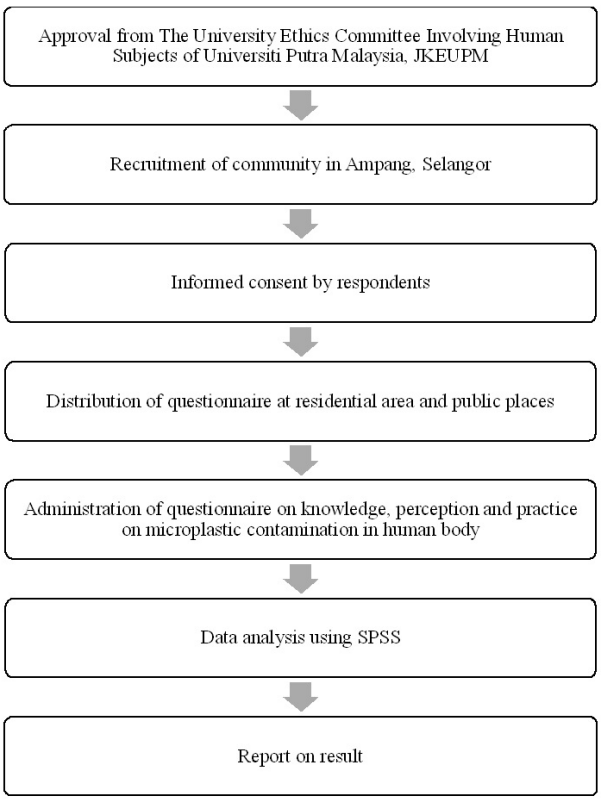

Figure 1 : Research Flowchart.

The questionnaire consists of four sections and takes approximately 20 minutes to answer. Section A consisted of eight sociodemographic background data. Multiple choice questions were given to be answered except for Age. Respondents who ticked 'Yes' for family history of disease is mandatory to input the type of disease which only be diagnosed by medical doctor. Section B included 10 questions to assess the knowledge of the community about the characteristics of microplastics, the pathway of contamination to human and the health effects of microplastic contamination. Three questions in Section C to evaluate the perception on microplastic contamination in human body including the awareness on the microplastic issue and the perceived threats to human. Meanwhile, Section D consisted of seven questions to assess the community's current practice and behaviour in avoiding the use of products containing microplastics in their daily lives.

Quality assurance and quality control

A pre-test of the questionnaire was conducted among a community residing in Kuala Lumpur, Malaysia to evaluate whether the questionnaire is understandable and fulfils the purpose of obtaining the relevant information and to identify any issues such as unclear wording or too long a duration to fill out the questionnaire. The questionnaire also undergoes a reliability test with the Cronbach alpha value being used to determine internal accuracy. The Cronbach alpha value for each section were 0.905 (Section B), 0.754 (Section C) and 0.854 (Section D). Cronbach alpha value that is higher than

0.7 is considered acceptable and good. Besides, the validation of the questionnaire was assessed by using the view of experts to assess the content validity. Two experts were chosen based on their expertise and recent publications on microplastics and public health.

Data analysis

The data collected was analysed using the statistical computer software IBM Statistical Package for Social Science (SPSS) version 27. Chi-square/Fisher's exact test was conducted to assess the association between all sociodemographic factors with the level of knowledge, perception and practice. Meanwhile, a multinomial logistic regression was conducted to identify the main predictor of practice level.

RESULTS

Sociodemographic data of the respondents

This study was able to recruit 437 participants. Table I showed the sociodemographic data of the respondents (n=437). There were higher percentages of females, young adults, tertiary education, urban, single, B40 (Below RM 4,849) and employed group than their counterparts. Besides, only 32.7% of the respondents have a family history of disease. The types of diseases reported by the respondents include hypertension, allergies, asthma, heart disease, diabetes, tuberculosis, thyroid, Systemic lupus erythematosus (SLE), cancer, tumor, and thalassemia carrier.

Level of knowledge, perception, and practice

Majority of the community obtained a moderate and high level of knowledge, somewhat positive and positive perception and moderate and good practice. In this study, the level of knowledge, perception and practice were counted as scores of 10 (high knowledge), 15 (positive perception) and 35 (good practice) respectively. The reported mean for each variable is 5.74 (SD=3.602) for knowledge, 11.75 (SD=2.158) for perception and 23.09 (SD=7.313) for practice level.

Half of the respondents have high knowledge (51.0%) of microplastic contamination in the human body (Table II). This result is seemingly good showing that knowledge about microplastics is high among the community in Ampang, Selangor. However, 29.3% of people with low knowledge is not a negligible number. Regarding perception towards microplastic contamination in the human body, most respondents

Table I : Sociodemographic data of the respondents (N=437)

Sociodemographic Factor	Response	No.	Percentage (%)
Gender	Male	140	32.0
	Female	297	68.0
Age Group	Young Adults (18-39)	396	90.6
	Middle-Aged Adults (40-59)	37	8.5
	Old Adults (60 and above)	4	4.0
Education Level	No Formal Education	35	8.0
	Primary Education	5	1.1
	Secondary Education	118	27.0
	Tertiary Education	279	63.8
Residential Area	Urban	381	87.2
	Rural	56	12.8
Marital Status	Married	146	33.4
	Divorced	4	0.9
	Single	287	65.7
Income Level	Below RM 4,849	382	87.4
	RM 4,850 – RM 10,959	45	10.3
	RM 10,960 and above	10	2.3
Employment Status	Employed	296	67.7
	Unemployed	141	32.3
Family History of Disease	Yes	143	32.7
	No	294	67.3

Table II : The association between knowledge level and sociodemographic factors (N=437)

Sociodemographic Factor	Low Knowledge	Moderate Knowledge	High Knowledge	Total	Chi-Square (X^2)	p-value
Gender						
Male	51 (11.7%)	26 (5.9%)	63 (14.4%)	140 (32.0%)	5.179	0.075
Female	77 (17.6%)	60 (13.7%)	160 (36.6%)	297 (68.0%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		
Age Group						
Young (18-39) Adults	109 (24.9%)	84 (19.2%)	203 (46.5%)	396 (90.6%)	9.573	*0.008
Middle-Aged (40-59) & Old (60 and above) Adults	19 (4.3%)	2 (0.5%)	20 (4.6%)	41 (9.4%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		
Education Level						
No Formal & Primary Education	36 (8.2%)	2 (0.5%)	2 (0.5%)	40 (9.2%)	114.291	*<0.001
Secondary Education	50 (11.4%)	27 (6.2%)	41 (9.4%)	118 (27.0%)		
Tertiary Education	42 (9.6%)	57 (13.0%)	180 (41.2%)	279 (63.8%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		
Residential Area						
Urban	120 (27.5%)	74 (16.9%)	187 (42.7%)	381 (87.2%)	7.249	*0.027
Rural	8 (1.8%)	12 (2.7%)	36 (8.2%)	56 (12.8%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		
Marital Status						
Married & Divorced	70 (16.0%)	23 (5.3%)	57 (13.0%)	150 (34.3%)	33.334	*<0.001
Single	58 (13.3%)	63 (14.4%)	166 (38.0%)	287 (65.7%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		
Income Level						
B40 (Below RM 4,849)	117 (26.8%)	77 (17.6%)	188 (43.0%)	382 (87.4%)	4.165	0.124
M40 (RM 4,850 – RM 10,959) & T20 (RM 10,960 and above)	11 (2.5%)	9 (2.1%)	35 (8.0%)	55 (12.6%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		
Employment Status						
Employed	112 (25.6%)	54 (12.4%)	130 (29.7%)	296 (67.7%)	32.933	*<0.001
Unemployed	16 (3.7%)	32 (7.3%)	93 (21.3%)	141 (32.3%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		
Family History of Disease						
Yes	46 (10.5%)	27 (6.2%)	70 (16.0%)	143 (32.7%)	0.850	0.654
No	82 (18.8%)	59 (13.5%)	153 (35.0%)	294 (67.4%)		
Total	128 (29.3%)	86 (19.7%)	223 (51.0%)	437 (100%)		

*Significant at p<0.05

Table III : The association between perception level and sociodemographic factors (N=437))

Sociodemographic Factor	Negative & Somewhat Negative Perception	Neutral Perception	Somewhat Positive Perception	Positive Perception	Total	Chi-Square (X^2)	p-value
Gender							
Male	2 (0.5%)	46 (10.5%)	67 (15.3%)	65 (14.9%)	140 (32.0%)	17.125 [b]	*<0.001
Female	2 (0.5%)	47 (10.8%)	119 (27.2%)	129 (29.5%	297 (68.0%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		
Age Group							
Young (18-39) Adults	2 (0.5%)	83 (19.0%)	147 (33.6%)	164 (37.5%)	396 (90.6%)	9.479 [b]	*0.020
Middle-Aged (40-59) & Old (60 and above) Adults	2 (0.5%)	10 (2.3%)	19 (4.3%)	10 (2.3%)	41 (9.4%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		
Education Level							
No Formal & Primary Education	1 (0.2%)	33 (7.6%)	4 (0.9%)	2 (0.5%)	40 (9.2%)	112.241 [b]	*<0.001
Secondary Education	2 (0.5%)	33 (7.6%)	52 (11.9%)	31 (7.1%)	118 (27.0%)		
Tertiary Education	1 (0.2%)	27 (6.2%)	110 (25.2%)	141 (32.3%)	279 (63.8%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		
Residential Area							
Urban	4 (0.9%)	87 (19.9%)	144 (33.0%)	146 (33.4%)	381 (87.2%)	5.321 [b]	0.131
Rural	0 (0%)	6 (1.4%)	22 (5.0%)	28 (6.4%)	56 (12.8%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		
Marital Status							
Married & Divorced	2 (0.5%)	54 (12.4%)	50 (11.4%)	44 (10.1%)	150 (34.3%)	30.231 [b]	*<0.001
Single	2 (0.5%)	39 (8.9%)	116 (26.5%)	130 (29.7%)	287 (65.7%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		
Income Level							
B40 (Below RM 4,849)	4 (0.9%)	86 (19.7%)	141 (32.3 %)	151 (34.6%)	382 (87.4%)	3.247 [b]	0.324
M40 (RM 4,850 – RM 10,959) & T20 (RM 10,960 and above)	0 (0%)	7 (1.6%)	25 (5.7%)	23 (5.3%)	55 (12.6%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		
Employment Status							
Employed	1 (0.2%)	81 (18.5%)	114 (26.1%)	100 (22.9%)	296 (67.7%)	29.355 [b]	*<0.001
Unemployed	3 (0.7%)	12 (2.7%)	52 (16.9%)	74 (16.9%)	141 (32.3%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		
Family History of Disease							
Yes	1 (0.2%)	37 (8.5%)	44 (10.1%)	61 (14.0%)	143 (32.7%)	5.626 [b]	0.113
No	3 (0.7%)	56 (12.8%)	122 (27.9%)	113 (25.9%)	294 (67.4%)		
Total	4 (0.9%)	93 (21.3%)	166 (38.0%)	174 (39.8%)	437 (100%)		

*Significant at p<0.05

[b]Analysed using Fisher Exact Test

Table IV : The association between practice level and sociodemographic factors (N=437)

Sociodemographic Factor	Poor Practice	Moderate Practice	Good Practice	Total	Chi-Square (X^2)	p-value
Gender						
Male	34 (7.8%)	59 (13.5%)	47 (10.8%)	140 (32.0%)	7.667	*0.022
Female	41 (9.4%)	134 (30.7%)	122 (27.9%)	297 (68.0%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Age Group						
Young (18-39) Adults	60 (13.7%)	179 (41.0%)	157 (35.9%)	396 (90.6%)	12.008	*0.003
Middle-Aged (40-59) & Old (60 and above) Adults	15 (3.4%)	14 (3.2%)	12 (2.7%)	41 (9.4%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Education Level						
No Formal & Primary Education	34 (7.8%)	5 (1.1%)	1 (0.2%)	40 (9.2%)	161.143	*<0.001
Secondary Education	24 (5.5%)	60 (13.7%)	34 (7.8%)	118 (27.0%)		
Tertiary Education	17 (3.9%)	128 (29.3%)	134 (30.7%)	279 (63.8%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Residential Area						
Urban	74 (16.9%)	165 (37.8%)	142 (32.5%)	381 (87.2%)	10.856	*0.004
Rural	1 (0.2%)	28 (6.4%)	27 (6.2%)	56 (12.8%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Marital Status						
Married & Divorced	50 (11.4%)	61 (14.0%)	39 (8.9%)	150 (34.3%)	44.917	*<0.001
Single	25 (5.7%)	132 (30.2%)	130 (29.7%)	287 (65.7%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Income Level						
B40 (Below RM 4,849)	73 (16.7%)	164 (37.5%)	145 (33.2%)	382 (87.4%)	8.153	*0.018
M40 (RM 4,850 – RM 10,959) & T20 (RM 10,960 and above)	2 (0.5%)	29 (6.6%)	24 (5.5%)	55 (12.6%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Employment Status						
Employed	66 (15.2%)	140 (32.0%)	90 (20.6%)	296 (67.7%)	32.346	*<0.001
Unemployed	9 (2.1%)	53 (2.1%)	79 (18.1%)	141 (32.3%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Family History of Disease						
Yes	40 (9.2%)	52 (11.9%)	51 (11.7%)	143 (32.7%)	17.898	*<0.001
No	35 (8.0%)	141 (32.3%)	118 (27.0%)	294 (67.4%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		

*Significant at p<0.05

have positive (38.0%) and somewhat positive (39.8%) perceptions. Only 21.3% of the respondents have a neutral perception, 0.9% of them have a somewhat negative perception and a negative perception of microplastic contamination in the human body (Table III). The community in Ampang, Selangor reported a slightly higher moderate level of practice (44.2%), followed by good level of practice (38.7%) and those who have poor practice (17.2%) is the lowest among all (Table IV). It is also a good sign that people have already started to instil environmentally friendly behaviour, probably due to current green policies in Ampang, Selangor.

Association between sociodemographic factors and knowledge, perception, and practice

The association between eight sociodemographic factors and the level of knowledge, perception and practice was analysed using Pearson Chi-Square Test (Table II, III, IV). The analysis with above 20% of the expected count that is less than 5 was analysed using Fisher's Exact Test since the total sample size is below 1000 which is considered a small sample size. In order to compare and predict between the groups, four sociodemographic factors (age, education level, marital status and income level) were combined to get a clearer analysis with enough sample size. Two lowest size groups were combined and analysed as one group. Finally, since there were no respondents who had negative perceptions, that group was excluded from the analysis.

Additionally, residential area factor will be excluded in further analysis due to the unclear status. According to Wilson et. al (43), Ampang is considered urban area since about 60% of the region's natural forest cover has been shifted to urbanisation or agriculture. It has been almost 8 years since the study conducted and the urbanisation in Ampang, Selangor has increased. Besides, the residential area data collected was self-reported by the residents that mostly were confused of their own residential area status. They are not aware whether there is a shift in status from rural to urban since it was less advertised by the local government. Hence, the result for the association between the residential area and knowledge, perception and practice were ignored.

The analysis showed that Ampang community's knowledge, perception, and practice level does associate with several sociodemographic factors. Four factors which are age (X^2=9.573, p=0.008), education level (X^2=114.291, p<0.001), marital status (X^2=33.334, p<0.001) and employment status (X^2=32.933, p<0.001) have a significant relationship (p<0.05) with the knowledge level of the community in Ampang, Selangor. The perception level also indicated a significant association with gender (X^2=17.125, p<0.001), age (X^2=9.479, p=0.020), education level (X^2=112.241, p<0.001), marital status (X^2=30.231, p<0.001) and employment status (X^2=29.355, p<0.001). Furthermore, all factors which are gender (X^2=7.667, p=0.022), age (X^2=12.008, p=0.007), education level (X^2=161.143, p<0.001), marital status (X^2=44.917, p<0.001), income level (X^2=8.153, p=0.018) employment status (X^2=32.346, p<0.001) and family history of disease (X^2=17.898, p<0.001) are shown to have significant relationship with the level of practice.

Table V : The relationship between the level of knowledge and perception with the level of practice in preventing microplastic contamination in human body among community in Ampang, Selangor

Independent Variable	Poor Practice	Moderate Practice	Good Practice	Total	Chi-Square (X^2)	p-value
Level of knowledge						
Low Knowledge	55 (12.6%)	58 (13.3%)	15 (3.4%)	128 (29.3%)	115.718	*p<0.001
Moderate Knowledge	8 (1.8%)	48 (11.0%)	30 (6.9%)	86 (19.7%)		
High Knowledge	12 (2.7%)	87 (19.9%)	124 (28.4%)	223 (51.0%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		
Level of perception						
Negative & Somewhat Negative Perception	2 (0.5%)	2 (0.5%)	0 (0%)	4 (0.9%)	140.850 [b]	*p<0.001
Neutral Perception	44 (10.1%)	46 (10.5%)	3 (0.7%)	93 (21.3%)		
Somewhat Positive Perception	25 (5.7%)	79 (18.1%)	62 (14.2%)	166 (38.0%)		
Positive Perception	4 (0.9%)	66 (15.1%)	104 (23.8%)	174 (39.8%)		
Total	75 (17.2%)	193 (44.2%)	169 (38.7%)	437 (100%)		

*Significant at p<0.05

[b]Analysed using Fisher Exact Test

Association between knowledge and perception level with the practice level

The level of knowledge and perception were analysed as independent variables to look at their association with the level of practice among the respondents. The same Chi-square method was used to identify the relationship (Table V). The results show that both knowledge (X^2=115.718, p<0.001) and perception (X^2=140.850, p<0.001) have a significant relationship with the level of practice.

Main predictor of practice level

A multinomial logistic regression test was conducted to determine the main predictor of practice level among the respondents. The level of practice was the dependent variable while the independent variables included the sociodemographic factors, knowledge and perception level. Table VI further shows the overall contribution for each independent variable to the level of practice. For the univariate analysis, education level (X^2=24.174, p<0.001), employment status (X^2=9.784, p=0.009) and perception level (X^2=35.445, p<0.001) were found to have significant attributes to the practice level. The most significant factor was the perception level based on its chi-square value.

Furthermore, Table VII displays the degree of association between each independent variable groups and the practice level. In this study, the regression coefficient highlighted which predictors significantly distinguish between respondents with moderate and poor practice and those with good practice which is the basic reference. First, the odds of people with no formal education and primary education background is 47.6 times higher to have poor practice as compared to those who have tertiary education background. Furthermore, the odds of an employed person having moderate practice is 2.03 times greater than the unemployed person. Similarly, the odds of the employed person having poor practice on preventing microplastic contamination in human body is 3.3 higher than those unemployed.

The perception level was also a significant predictor for the practice level. Those who have neutral perception have 14.3 times the odds of moderate versus good practice than those with positive perception. Besides, there is a high number odds of somewhat negative group of respondents having moderate practice than the group with positive perception. For the next logit which is poor versus good practice, it was found that people with neutral perception having poor practice is 52.8 times greater than the odds among people with positive perception. Meanwhile, respondents who had somewhat positive perception were 6.7 times more likely to have poor perception than the respondents with positive perception. Indeed, the community's practice could be predicted by looking at their perception level whereas the more positive one's perception is, their practice in preventing microplastic contamination in the human body will be better.

DISCUSSION

The level of knowledge, perception and practice is important to counter the microplastic issue in Malaysia. There is a non-negligible amount of low knowledge (29.3%) on microplastic contamination in human body among the community in Ampang, Selangor. Previous studies by Cammalleri et al. (41) and Deng et al. (40) found similar percentages of lack of knowledge among students in the Sapienza University of Rome (25%) and community in Shanghai (26%) which they had never heard of microplastics. The community in Ampang, Selangor has a slightly higher percentage of

Table VI : The significance of sociodemographic factors, knowledge and perception in univariate analysis overall model

Effect	Model Fitting Criteria	Likelihood Ratio Tests	
	-2 Log Likelihood of Reduced Model	Chi-Square	p-value
Gender	449.181	1.736	0.420
Age Group	449.069	1.624	0.444
Education Level	471.619	24.174	*0.000
Marital Status	448.424	0.979	0.613
Income Level	451.776	4.331	0.115
Employment Status	457.229	9.784	*0.008
Family History of Disease	449.890	2.444	0.295
Level of Knowledge	451.689	4.244	0.374
Level of Perception	482.890	35.445	*0.000

*Significant at p<0.05

Table VII : Predictors of practice level (multinomial logistic regression test, N=437)

Practice Level	Independent Variables	Regression Coefficient (B)	Standard Error	Wald	Odds Ratio (Exp (B))	p-value
Moderate	**Gender**					
	Male	-0.185	0.265	0.488	0.831	0.485
	Female					
	Age Group					
	Young Adults	0.308	0.516	0.357	1.361	0.550
	Middle & Old Adults					
	Education Level					
	No Formal & Primary Education	1.037	1.210	0.734	2.819	0.392
	Secondary Education	0.173	0.286	0.367	1.189	0.545
	Tertiary Education					
	Marital Status					
	Married & Divorced	0.089	0.317	0.078	1.093	0.779
	Single					
	Income Level					
	B40	-0.056	0.369	0.023	0.945	0.879
	M40 & T20					
	Employment Status					
	Employed	0.708	0.259	7.478	2.031	*0.006
	Unemployed					
	Family History of Disease					
	Yes	-0.006	0.256	0.000	0.994	0.983
	No					
	Knowledge Level					
	Low	0.553	0.393	1.982	1.739	0.159
	Moderate	0.356	0.311	1.308	1.427	0.253
	High					
	Perception Level					
	Somewhat Negative	20.259	1.462	191.976	$6287x10^5$	*<0.001
	Neutral	2.662	0.671	15.739	14.321	*<0.001
	Somewhat Positive	0.460	0.266	3.001	1.584	0.083
	Positive					
Poor	**Gender**					
	Male	0.284	0.420	0.459	1.329	0.498
	Female					
	Age					
	Young Adults	-0.464	0.717	0.420	0.628	0.517
	Middle & Old Adults					

Practice Level	Independent Variables	Regression Coefficient (B)	Standard Error	Wald	Odds Ratio (Exp (B))	p-value
	Education Level					
	No Formal & Primary Education	3.862	1.252	9.510	47.559	*0.002
	Secondary Education	0.628	0.454	1.908	1.873	0.167
	Tertiary Education					
	Marital Status					
	Married & Divorced	0.457	0.472	0.934	1.579	0.334
	Single					
	Income Level					
	B40	1.469	0.865	2.883	4.345	0.090
	M40 & T20					
	Employment Status					
	Employed	1.180	0.524	5.073	3.255	*0.024
	Unemployed					
	Family History of Disease					
	Yes	0.612	0.427	2.054	1.845	0.152
	No					
	Knowledge Level					
	Low	0.911	0.582	2.450	2.486	0.118
	Moderate	0.169	0.570	0.088	1.184	0.767
	High					
	Perception Level					
	Somewhat Negative	21.729	0.000		2732×10^6	
	Neutral	3.967	0.925	18.377	52.842	*<0.001
	Somewhat Positive	1.903	0.625	9.281	6.707	*0.002
	Positive					

*Significant at p<0.05

low knowledge about microplastics as compared to those from Rome and Shanghai. The small differences could be due to several factors such as the community's location and the country's approach on microplastic education through legislation and policy.

Based on further analysis, it was seen that age, education level, marital status and employment status have a significant relationship with the level of knowledge on microplastic contamination in the human body. Among these four, education level has the highest strength of association (Cramer's V=0.366). People with higher educational backgrounds tend to receive more information about environmental pollution and microplastic contamination, especially those who have a background education in a similar subject. A previous study by Gumrukcuoglu et. al (44) found that students with a higher level of education do have generally high consciousness of the environment. Another study by Henderson and Green (45) stated that one group that is more conscious about the environment was more knowledgeable about the microplastic problem.

Moreover, the perception of microplastic contamination in human body among the community in Ampang, Selangor showed positive results. The community in Ampang, Selangor were found to have highly conscious of the harms that microplastic could pose. The current finding is in line with the previous study by Deng et al. (40) where 75% of their respondents expressed concern or even excessive concern on the risk that microplastics might have on human health. This positive result was also in line with a previous study of German people who were found to have high concerns about microplastic risks (46). When comparing both studies with the current research, it was found that people do have high concerns about microplastic risks after being made aware that microplastics may have a negative impact on human health.

In terms of the association between the sociodemographic groups with the perception level, it was found that gender, age, education level, marital status and employment status have a statistically significant relationship. The previous literature found that women perceive higher

danger risk of microplastic than males (47). It is in line by the findings in this study where the proportion of female with positive perception is higher than the male respondents. In general, this research study could inform that majority of the community in Ampang, Selangor is aware of the microplastic issue since majority of the respondents have positive and somewhat positive perceptions. This is a good sign for the community to at least have basic information and awareness on the microplastic issue which could improve their daily behaviour.

Another interesting finding in this research was the low number of poor practices among the community in Ampang, Selangor. Since human action is the sole known cause of marine litter of microplastics, modifying attitudes and behaviour are essential for combating litter in the natural environment (40). This result suggested a piece of evidence that the community in Ampang, Selangor may not contribute the most to the plastic contamination in Klang River. Based on the analysis, all sociodemographic factors (gender, age, education level, marital status, income level, employment status and family history of disease) have a statistical significance association with the level of practice. The results showed similar findings with several different studies. Soares et al. (42) found that the fact that older people have observed the decline in environmental quality may contribute to the tendency of this age group to engage in more environmentally conscious attitudes. Besides, Dowarah et al. (48) discovered that in general, attitude and behaviour were positive regardless of gender, educational level, or topic studied among the students in India.

Additionally, this research found that females had higher percentage of moderate and good behaviour as compared to males. It is similar with previous study by Dowarah et al. (48) which found that females had higher mean scores of good attitude level towards microplastic pollution than the male students. The current study could reinforce the opinion of Dowarah et al. (48) which believes that women are essential to the fight against environmental degradation. Now we understand that women possess better environmentally good behaviour, actions must be taken to enhance the behaviour and empower women leaders that could prevent microplastic contamination in the environment and human body at once.

Furthermore, the level of knowledge and perception both have a significant relationship with the level of practice. These findings were in line with the previous study by Beeharry et al. (49) which found that human behaviour is determined by the knowledge, perception, attitude, level of concern, and willingness to take action about this environmental issue at the individual level, whereas behaviour at the societal level is influenced by policies and laws. In another study by Kramm et al. (46), respondents that have higher information and understanding about microplastics may have greater perception on the risk of microplastics on human health. This evidence showed that knowledge and perception level are associated with each other. It is suggested that the higher the knowledge that a person have about microplastic contamination in human body, the better their perception towards the health impacts whereas their practice to prevent microplastic contamination in human body will also be positive.

The level of perception showed higher strength of association as compared to the knowledge level. The study by Dowarah et al. (48) also discovered that those who were aware of microplastics were more likely to have the required positive attitude and behaviour to combat plastic pollution. Hence, people perception towards an issue will determine the behaviour whether it will be inclined towards positive behaviour or negative behaviour. Besides, people with knowledge will be aware of the issue and they will act based on what they know. However, knowledge itself won't change anything if the person does not have the willingness to act. An important concept to curb the microplastic problem is actually to incorporate one's knowledge and information. This action could help to lessen the problem which people will reduce the production of microplastic-related products (41).

Among all factors studied, education level, employment status and perception level found to be the predictors of practice in preventing microplastic contamination in human body. The level of perception is selected as the main predictor to the practice level of the community based on its highest chi-square value. The perception of the community in Ampang, Selangor is seemingly positive, which explains the high number of moderate and good practices in preventing microplastic contamination in Ampang, Selangor. Understanding different perceptions of people might be a useful point to plan a successful awareness program that aims to educate. Furthermore, the analysis has shown that the odds of people who had the neutral perception possessing poor and moderate practice versus good practice is much greater than those who had somewhat positive perception. These findings suggested that the perception level should be towards the positive side in order to not experiencing poor or moderate practice on preventing microplastic contamination in the human body. Therefore, since the community in Ampang, Selangor is aware of the microplastic issue, the government should plan and conduct a better plan to curb the microplastic issue that is in line with their perception level.

To sum up, the findings of this study could be used for future research and some recommendations should be included when planning for future developments. The level of knowledge, perception and practice level of any community could be improved once enough shreds

of evidence were found to support the government's effort to curb this environmental issue. Therefore, these factors could be taken into account when planning on programs, policies or projects that involve prevention of microplastic issues on the environment and humans through behavioural actions. Based on the study results, the mitigation measures could be focused more towards the males, age of 40 and above, lower educational level, married and divorcees, higher income level and unemployed groups. More programs should be conducted related to microplastic and its health effects to reduce the knowledge gap, enhance awareness and cultivate good practice among the community. Therefore, there is a need to increase awareness of the people so that positive perceptions and high knowledge could be achieved to instill good behaviour related to the microplastic issue among the community.

CONCLUSION

In conclusion, this study demonstrates that the public's understanding of microplastics is insufficiently comprehensive. The community's knowledge, perception and practice shall be improved in the future while considering their sociodemographic background. Strengthening the public's perception on microplastic risks to humans may reinforce the reduction of microplastic abundance in the environment which ultimately reduces the likelihood of exposure to humans.

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