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RESEARCH ARTICLE

Parental Awareness of Microplastic Pollution and its Relation with Healthy Living Education Consciousness

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ABSTRACT

Objective: This study was conducted to determine the relationship between parents' awareness of microplastic pollution and their levels of awareness regarding their children's physical health, nutrition, hygiene, mental health, and social activity.

Methods: This study was conducted based on the correlational survey model. The study group consisted of parents residing in different cities of Turkey who had at least one child aged between 0 and 18 years during the research period. A total of 362 parents participated in the study. Data were collected from February to May 2023 using the "Personal Information Form," "Microplastic Pollution Awareness Scale," and "Parental Healthy Living Education Consciousness Level" scales. Descriptive statistics [number, percentage, mean, standard deviation, median (25th-75th percentile)], Mann-Whitney U, Kruskal-Wallis H tests, and Spearman correlation analysis were used in the evaluation of the data.

Results: The average age of the participating parents was found to be 39.0±7.1, 53.9% were male, 92.8% were married, 67.2% had an education level of an associate degree or higher, and 47.2% had two children. Women's physical health, nutrition, hygiene, and mental health scores were statistically significantly higher than those of men, and it was determined that the parents participating in this study had a high awareness of microplastic pollution. The nutrition and mental health scores of parents with education levels of high school or lower were found to be statistically significantly lower than those with an associate degree or higher. Weak positive linear relationships were found between physical health and awareness of microplastic pollution (r=0.142; p=0.007).

Conclusions: In line with the results of the study, educational programs can be developed for parents, especially fathers, to help their children develop healthy eating and hygiene habits, and awareness levels of families regarding physical and mental health can be increased. Informative trainings can be created and disseminated to encourage mothers and fathers to equally share responsibilities by addressing gender roles in society.

Keywords: Child, Parent, Awareness, Microplastics, Healthy Living

INTRODUCTION

Plastics and synthetic organic polymers have become ubiquitous in daily life over the past 75 years, with global production surpassing 367 million tons in 2020. Despite its versatile uses and benefits, plastic accumulation is predicted to triple by 2050, however, concerns have been raised about its environmental impact (1). Plastics are attractive in industry and commerce because of their low weight, durability, flexibility, low cost of production, easy availability, and mass production (2). They are valued for their affordability, light weight, and durability. However, their resistance to corrosion and decomposition poses a significant environmental challenge, reducing their practicality (3). The waste generated from plastic production and consumption poses serious risks to both the environment and public health (4). With the influence of environmental factors, these plastic wastes spread over vast areas and gradually break down into smaller particles, forming microplastics (5).

Microplastics are substances frequently detected in water, soil, and atmospheric environments and pose a serious threat to environmental safety and human health (6). Microplastics, defined as particles smaller than 5 mm, are emerging pollutants primarily originating from plastics. Evidence of microplastics in the environment dates back to the 1970s (7). Today, industries like pharmaceuticals and cosmetics incorporate microplastics into many daily products, leading to environmental pollution through wastewater (8, 9). Microplaastics are found in surface waters (10), beaches (11), food products such as salt and honey (12), bottled waters, on land, and in the air (13). The small size, challenges in detection, and potential to cause adverse effects

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make them a significant concern for the environment, animals, and human health (14).

Exposure to microplastics through ingestion, inhalation, and skin contact can occur via products, food items, and airborne particles, leading to oxidative stress, inflammation, and toxicity in biological systems. This may result in chronic inflammation and increased risk of neoplasia. In addition, microplastics can release absorbed pollutants and pathogenic organisms (15, 16, 17).

Since 1948, the World Health Organization has defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." (18). In today's societal conditions, families bear a significant and heavy responsibility. Parents have important tasks and responsibilities in the physical, motor, cognitive, social, and emotional development of their children, as well as their physical and mental health and education. Parents' understanding of child development significantly influences their approach to raising children. For instance, research has shown that mothers who communicate positively with their children typically possess greater knowledge of child development than those who do not (19).Knowledge of child development involves understanding the typical behaviors expected from a child at a given stage. This allows the assessment of the child's capabilities and setting reasonable expectations for their behavior (20). Accessing health services, safeguarding children from physical harm (e.g., emphasizing seat belt and helmet use), and possessing knowledge about health and safety, including promoting hygiene and nutrition, are vital aspects of parenting (21).

Upon reviewing the relevant literature, no study has simultaneously addressed and evaluated the healthy lifestyle education awareness levels of parents and their knowledge levels about microplastic pollution. The aim of this study was to determine the relationship between parents' awareness of their children's physical and mental health, nutrition, hygiene, mental health/social activity, and awareness of microplastic pollution.

MATERIALS AND METHODS

Research design

This study was conducted using the relational scanning model. Scanning models represent a research approach that aims to describe a situation in detail, either in the past or in the current state. In the relational scanning model, the event, individual, or object that is the subject of the research is defined within its unique conditions. In line with this objective, detailed descriptions of both situations are first made in terms of specific variables, and then these descriptions are compared based on common criteria (22)

Study group

The study group consisted of parents living in different cities of Turkey who had at least one child between the ages of 0 and 18 years during the research period. A total of 362 parents participated in the study. Data were collected between February and May 2023.

Data collection and implementation tools

In this study, data collection forms were created using Google Forms. Participants were informed that participation was voluntary and that they were free to participate or not. Participants who agreed to participate answered the questions in approximately 10-15 minutes. The data were collected over approximately 4 weeks. Participants were able to choose the most suitable time to answer the questions and provided more honest answers because their identities were not disclosed. .In this study, the "Personal Information Form," "Microplastic Pollution Awareness Scale," and "Parental Healthy Living Education Consciousness Level" scales prepared by the researchers were used.

Personal information form

The "Personal Information Form," prepared by the researchers includes questions about the parents' ages, educational backgrounds, occupations, and income statuses, as well as the number and ages of their children.

Microplastic Pollution Awareness Scale (MPAS)

The Microplastic Pollution Awareness Scale is a scale developed to measure individuals' awareness of microplastic pollution (23).[17] Exploratory Factor Analysis (EFA) was applied to the data obtained from the application of the scale to 586 participants, revealing that the scale has a 3-factor structure and that the factors explain 49.57% of the total variance. Confirmatory Factor Analysis (CFA) was then conducted to confirm the obtained factor structure. The overall reliability coefficient of the scale was 81%. The Microplastic Pollution Awareness Scale is a Likert-type scale and consists of 14 items, including 5 negative and 9 positive items. The maximum score that can be obtained from the scale is 28, and the score obtained from the scale is directly proportional to the individual's level of awareness of microplastic pollution. There are 3 factors. Factor 1: Awareness of preventing microplastic pollution; Factor 2: Awareness of the effects of microplastic pollution on organisms; Factor 3: Awareness of the effects of microplastic pollution on human health. In this study, the total Cronbach's α coefficient for the Microplastic Pollution Awareness Scale was calculated as 0.885, for Factor 1 as 0.805, for Factor 2 as 0.748, and for Factor 3 as 0.758.

Parental Healthy Living Education Consciousness Level (PHLECL)

In the initial stage, a draft scale with 47 items was prepared for the Parental Healthy Living Education Consciousness Level Scale, and after obtaining expert opinions, a draft form with 40 items was created (24). To test the comprehensibility of the draft scale, a face-to-face interview survey was conducted with 30 parents, and the reliability of the scale was determined to be 92% based on the analysis of the responses obtained. The 40-item scale was then applied to 390 individuals; however, 10 items that violated the reliability and validity according to confirmatory factor analysis and other statistical methods were excluded. Consequently, a four-factor scale consisting of 30 items was developed. These factors are, respectively, named "Physical Health, Nutrition, Hygiene, and Mental Health/Social Activity."

When examining the Cronbach's alpha reliability coefficients, it is observed that these coefficients are calculated as 0.808 for the "Physical Health" factor, 0.758 for the "Nutrition" factor, 0.846 for the "Hygiene" factor, and 0.903 for the "Mental Health/Social Activity" factor. Accordingly, it can be concluded that all factors have high reliability. The Cronbach's alpha reliability coefficient for the 30 items on the scale was calculated as 0.9485, indicating that the scale is highly reliable. In this study, it was found that the Cronbach's alpha coefficients for the total score and subscales of the scale were 0.96, 0.85, 0.88, 0.93, and 0.96, respectively.

Data analysis

For the analysis of the data obtained from this study, the SPSS (Statistical Package for Social Sciences) for Windows 26 (SPSS Inc., Chicago, IL, USA) software package was used. The assumption of normal distribution of quantitative variables was checked using the Kolmogorov-Smirnov test. Descriptive statistics for quantitative variables with normal distribution were presented as mean ± standard deviation, whereas for quantitative variables not showing normal distribution, median (25th-75th percentile) was used. Descriptive statistics for categorical variables are presented as frequency and percentage. Mann–Whitney U and Kruskal-Wallis H tests were used to compare scale scores among independent groups. The relationships between variables were examined using Spearman's correlation analysis. A significance level of $p < 0.05$ was considered statistically significant.

Ethical aspects of the Study: Permission dated 10.11.2022 and numbered 42161/76 was obtained from the Kayseri University Non-Interventional Clinical Research Ethics Committee.

RESULTS

This section discusses the sociodemographic characteristics of the participants, comparisons of scale scores based on various variables, and relationships between the scales.

When examining Table 1, the minimum and maximum values of the scores obtained from the Parental Healthy Living Education Consciousness Level and Microplastic Pollution Awareness Scales, as well as the mean and standard deviation scores, are provided.

The average age of the parents participating in the study was found to be 39.0 ± 7.1, with 53.9% being male, 92.8% being married, 47.2% having two children, 67.2% having their own education level, and 63.5% having their spouse's education level at the associate's degree or bachelor's degree (Table 2).

Parental Healthy Living Education Consciousness Level Scale and Microplastic Pollution Awareness Scale scores were compared in female and male participants (Table 3). There was a statistically significant difference between females and males in physical, nutrition, hygiene, and mental health scores. Female scores in physical health, nutrition, hygiene, and mental health were statistically significantly higher than those of males (p=0.008; p=0.001; p=0.017; p=0.032). There were no statistically significant differences between genders in MPAS total, factor 1, factor 2, and factor 3 scores (p>0.05).

The comparison results of the Parental Healthy Living Education Consciousness Level Awareness Level Scale and Microplastic Pollution Awareness Scale scores according to marital status are presented in Table 4. We found a statistically significant difference between married and single individuals in terms of nutrition and hygiene scores. The scores for nutrition and hygiene were statistically significantly higher for married individuals than for singles (p=0.038; p=0.033). No statistically significant difference was determined between married and single individuals in terms of physical and mental health, MPAS total score, factor 1, factor 2, and factor 3 scores (p>0.05). Considering that the highest score obtained from the MPAS is 28, it was observed that the awareness of the parents participating in this study regarding microplastic pollution was high.

Parental Healthy Living Education Consciousness Level Scale and Microplastic Pollution Awareness Scale scores were compared according to the participants' education levels (Table 5). The analysis revealed no statistically significant difference

Table 1. Minimum and Maximum Scores, Arithmetic Means, and Standard Deviations of Parental Healthy Living Education Consciousness Level Scale and Microplastic Pollution Awareness Scale scores

Scales	n	Minimum	Maximum		Standard Deviation
PHLECL					
Physical Health	362	7	35	27,64	5,28
Nutrition	362	4	20	16,53	3,35
Hygiene	362	6	30	26,18	4,89
Mental Health	362	13	65	55,52	9,87
MPAS					
MPAS Total	362	7	28	22.52	4,95
Factor 1	362	2	10	8,69	1,85
Factor 2	362	2	10	8,03	1,94
Factor 3	362	0	8	5,78	1,94

in physical health, nutrition, hygiene, mental health, MPAS total score, factor 1, factor 2, and factor 3 scores based on educational status (p>0.05).

Parental Healthy Living Education Consciousness Level Scale and Microplastic Pollution Awareness Scale scores were compared according to the spouse's education level (Table 6). A statistically significant difference was observed in the nutritional and mental health scores based on spouse's educational status. The nutrition and mental health scores of individuals whose spouse had a secondary education were significantly lower than those with an associate degree, undergraduate, or postgraduate education (p < 0.05).

Results of correlation analysis between the scores of the Parental Healthy Living Education Consciousness Level and Microplastic Pollution Awareness Scale and the age and number of children are presented in Table 7. There was a weak negative linear relationship between age and nutrition (r=-0.150; p=0.05) and mental health (r=-0.200; p<0.01).

The correlation analysis results between the scores of the Parental Healthy Living Education Consciousness Level Scale and the Microplastic Awareness Scale are presented in Table 8. A weak linear relationship was found between physical health and the total score of the Microplastic Pollution Awareness Scale (r=0.142; p<0,05), factor 2 (r=0.141; p<0,05) and factor 3 (r=0.125; p<0.05).

Table 2. Sociodemographic Characteristics of Participants

Sociodemographic Characteristics	n (%)
Age (±SS)	39,0±7,1
Gender	
Female	167 (46,1)
Male	195 (53,9)
Marital Status	
Married	336 (92,8)
Single	26 (7,2)
Education Level	
Secondary Education or below	52 (14,4)
College or bachelor's degree	238 (65,7)
Master's or PhD	72 (19,9)
Couple Education Level	
Secondary Education or below	84 (23,2)
College or bachelor's degree	230 (63,5)
Master's or PhD	48 (13,3)
Children Number	
1 Child	140 (38,7)
2 Children	171 (47,2)
3 children or older	51 (14,1)

n: frequency; %: Percentage, $\bar{X}$: Mean, SS: standard deviation.

Table 4. Comparison of scale scores according to marital status

	Marital Status			
	Married	**Single**	**Z**	**p**
PHLECL				
Physical Health	28 (25 - 31)	29 (20,8 - 33)	-0,053	0,958
Nutrition	17 (15 - 19)	16,5 (10,8 – 18,5)	-2,075	**0,038**
Hygiene	28 (24 - 30)	25,5 (17,8 – 29,3)	-2,127	**0,033**
Mental Health	58 (52 - 63)	57,5 (38,5 – 64,3)	-0818	0,413
MPAS				
MPAS Total	24 (19 - 27)	21,5 (16,8 - 26)	-1,200	0,230
Factor 1	10 (8 - 10)	9 (6 - 10)	-1,536	0,124
Factor 2	9 (6,3 - 10)	7,5 (6 - 10)	-0,962	0,336
Factor 3	6 (4 - 8)	6 (4 - 7)	-0,905	0,366

Z: Mann–Whitney U test statistical descriptive statistics are presented as median (25th - 75th percentile).

Table 3. Comparison of Scale Scores by Gender

	Gender			
	Female	**Male**	**Z**	**p**
PHLECL				
Physical Health	29 (26 - 32)	28 (24 - 31)	-2,644	**0,008**
Nutrition	18 (16 - 20)	17 (14 - 19)	-3,253	**0,001**
Hygiene	29 (25 - 30)	27 (24 - 30)	-2,378	**0,017**
Mental Health	59 (53 - 63)	56 (51 - 63)	-2,141	**0,032**
MPAS				
MPAS Total	24 (18 - 26)	24 (19 - 27)	-0,596	0,551
Factor 1	10 (8 - 10)	10 (8 - 10)	-0,210	0,834
Factor 2	8 (6 - 10)	9 (6 - 10)	-1,269	0,204
Factor 3	6 (4 - 8)	6 (4 - 8)	-0,237	0,813

Z: Mann–Whitney U test statistical descriptive statistics are presented as median (25th - 75th percentile).

Table 5. Comparison of scale scores by education level

	Education Level				
	Secondary education or below	College or bachelor's degree	Master's or PhD	H	p
PHLECL					
Physical Health	27 (22,3 - 32)	28 (25 - 31)	29 (27 - 32)	3,139	0,208
Nutrition	16 (12,3 - 19)	17 (15 - 19)	18 (15,3 - 19)	4,048	0,132
Hygiene	28 (22 - 30)	28 (24 - 30)	28 (26 - 30)	1,439	0,487
Mental Health	57,5 (17,3 - 62)	58,5 (51 - 64)	57 (53 - 62)	2,602	0,272
MPAS					
MPAS Total	24,5 (17,3 - 26)	24 (19 - 27)	24 (19 - 27)	0,833	0,659
Factor 1	10 (7 - 10)	10 (8 - 10)	9 (8 - 10)	0,674	0,714
Factor 2	9 (6 - 10)	9 (6 - 10)	8 (7 - 10)	0,623	0,732
Factor 3	6 (4 - 7)	6 (4 - 8)	6 (4 - 8)	0,306	0,858

H: Kruskal-Wallis H Test Statistic
Descriptive statistics are presented as median (25th - 75th percentile).

Table 6. Comparison of scale scores according to spouse educational status

	Spouse's Educational Status				
	Secondary education or below	College or bachelor's degree	Master's or PhD	H	p
PHLECL					
Physical Health	27 (23 - 31)	28 (26 - 31)	29 (26,3 – 32,8)	4,860	0,088
Nutrition	16 (12 -18,8)[a]	17 (15 - 19)[b]	18 (16 - 20)[b]	12,244	**0,002**
Hygiene	28 (22 - 30)	28 (24 - 30)	29 (26 - 30)	4,843	0,089
Mental Health	55,5 (48,3 - 63)[a]	59 (52 - 63)[b]	60 (53 - 64)[b]	6,567	**0,037**
MPAS					
MPAS Total	24 (18 - 26)	24 (18 - 27)	24,5 (22 - 27)	0,362	0,597
Factor 1	10 (8 - 10)	10 (8 - 10)	10 (8 - 10)	0,916	0,633
Factor 2	8,5 (6 - 10)	8 (6,8 - 10)	9 (7 - 10)	0,733	0,693
Factor 3	6 (4 - 8)	6 (4 - 8)	6,5 (5 – 7,8)	1,035	0,596

H: Kruskal-Wallis H Test Statistic
Descriptive statistics are presented as median (25th - 75th percentile).
Similar letters within the same row indicate statistical similarity, whereas different letters indicate statistical differences.

Table 7. Spearman correlation coefficients of age, number of children, and scale scores

PHLECL	Age	Children Number
Physical Health	-0,088	-0,045
Nutrition	**-0,150***	-0,079
Hygiene	-0,080	0,018
Mental Health	**-0,200****	-0,092
MPAS Total	**0,032**	**0,024**
Factor 1	-0,024	0,066
Factor 2	0,024	0,024
Factor 3	0,056	0,026

*p<0,05, **p<0,01

Table 8. Spearman's correlation coefficient between scale scores

	Physical Health	Nutrition	Hygiene	Mental Health
MPAS Total	0,142*	0,123	0,087	0,094
Factor 1	0,046	0,019	0,027	0,033
Factor 2	0,141*	0,121	0,087	0,097
Factor 3	0,125*	0,121	0,076	0,073

**p<0,05*

DISCUSSION AND CONCLUSION

The study investigated the relationship between parents' awareness levels of their children's physical health, nutrition, hygiene, mental health/social activity, and microplastic pollution. The frequency and type of plastic material use in our daily lives can be noticeable. Plastic materials are used in almost every place, such as homes, workplaces, and streets. Knowledge regarding microplastic toxicity remains limited and largely depends on exposure concentration, particle characteristics, absorbed pollutants, involved tissues, and individual sensitivity, requiring further research (15). Various studies have indicated the potential for metabolic disorders, neurotoxicity, and increased cancer risk in humans. Additionally, microplastics can release both adsorbed substances on their surfaces and their component compounds (13). Some diseases can be caused by social factors such as poverty (malnutrition), dietary habits (high sugar, fat) and behaviors (alcoholism). The social disadvantages mentioned above can lead to conditions

such as diabetes (25), chronic liver disease (26), and chronic kidney disease (27). Similarly, in the case of microplastics, various social factors such as inhalation and skin exposure routes, poverty (housing and hygiene), occupation (working in synthetic textile factories), and personal behavior (use of cosmetics containing microplastics) can influence and determine microplastic exposure (13). In this study, it was observed that parents had an average score of 22.5 points on the microplastic pollution awareness scale. The highest possible score was 28. The parents who participated in this study had a high awareness of microplastic pollution. When reviewing the relevant literature, it was found that there had been no research conducted specifically with parents on this topic, but studies had been conducted with students and adults. For example, a study conducted in India (28) observed that women showed more awareness than men and were also more willing to adopt pro-environmental practices. Educational qualification and the field of education also had a significant and directly proportional impact on the level of awareness. Despite adequate awareness of plastic pollution, awareness specific to microplastics was limited. In another study on this topic, it was stated that while most participants demonstrated a good level of awareness regarding plastic waste, about half of them heard the word "microplastic" for the first time (29). Another study conducted in China showed that only 74% of the participants had heard of microplastics for the first time (30). In this study, mothers were found to have statistically significantly higher scores in physical health, nutrition, hygiene, and mental health than fathers. The nutrition and hygiene scores of married parents were also statistically significantly higher than those of singles. As primary caregivers at home, parents can play a vital role in improving the child's health outcomes if they possess appropriate knowledge, information, and resources. Parental education can directly and indirectly affect children's health through various channels. This research indicates that women have statistically significantly higher physical, nutritional, hygiene, and mental health. These results emphasize the potential effects of gender on health and lifestyle factors. Regarding family health, the role of the mother is critical. Mothers take care of the health needs of her children. Additionally, she is responsible for aspects related to nutrition, hygiene, and health requirements. Traditionally, mothers have been seen as the primary providers of food to children because they are often the primary caregivers (31, 32). The mother is obligated to raise healthy infants and children, as she determines their health and illness. A previous study has shown that key factors influencing family health are the mother's education level, age, and economic status, as well as her knowledge and attitudes regarding preventive measures and disease treatment (33). In our society, it is commonly observed that men are generally assigned the role of father, leader, and breadwinner, while women are often given the roles of mother and homemaker (34). These gender differences can be addressed in a context in which society assigns different social roles and expectations to women and men. It is conceivable that women often carry more responsibility within the family and therefore may focus more on healthy lifestyle habits. The nutrition and mental health scores of individuals whose spouses had an education level of secondary education or below were significantly lower than those with spouses who had an associate, undergraduate, or postgraduate degree. We found weak positive linear relationships between physical health and awareness of microplastic pollution. The argument is emphasized that educated parents can more effectively shape the health outcomes of their children. Firstly, despite using the same resources and time, these learners can use them more effectively than less educated parents. For example, seeking medical services at appropriate times, adopting preventive care practices, practicing better hygiene, making healthy dietary choices, timely vaccination, paying attention to birth spacing, and utilizing prenatal/postnatal and neonatal care services that support the child's health. Second, being generally educated enables individuals to enter better-paying jobs and provides them with more comprehensive health insurance opportunities for their families. Third, educated individuals tend to have stronger social networks, effective communication skills, personal control, and healthy behaviors. They also have a lower future discount rate, thereby increasing the likelihood of investing in family health care in the future (35). The parents who participated in this study had high awareness of microplastic pollution. Mothers exhibited higher levels of awareness regarding the physical, nutritional, hygiene, and mental health of their children compared to fathers. A weak positive relationship was found between parents' awareness of physical health and microplastic pollution. Considering the limited number of studies conducted on this topic and the results of this study, educational programs could be developed for parents, especially fathers, to promote healthy nutrition and hygiene habits in their children. Additionally, efforts could be made to increase awareness among families about physical and mental health issues. Encouraging equal sharing of responsibilities between mothers and fathers in line with gender roles can be promoted. Although there is no single correct approach to parenting, finding common ground within the framework of scientific approaches and conditions that prioritize the child's highest benefit undoubtedly leads to positive outcomes for the child's physical and mental health.

The limitations of the current study must be acknowledged when interpreting and applying the findings derived from the study's content. The study's scope is confined to the data collected from the sample group and research instruments. The parents involved in the study constitute the investigated population. It is recommended to conduct studies using different samples and educational interventions as part of the research.

Ethics Committee Approval: This study was approved by Clinical Research Ethics Committee of Kayseri University (42161 – 10.11.2022)

Informed Consent: Written consent was obtained from the participants.

Peer Review: Externally peer-reviewed.

Author Contributions: Conception/Design of Study- K.M.K., E.M.; Data Acquisition- K.M.K., E.M.; Data Analysis/Interpretation- ; K.M.K., E.M. Drafting Manuscript- K.M.K., E.M.; Critical Revision of Manuscript- K.M.K., E.M. ; Final Approval and Accountability- K.M.K., E.M.

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