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Original Research Article

Microplastic Identification in the Faeces of Pregnant Women

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Abstract

Microplastics come from various types of materials in the form of pieces, fibres, fragments, granules, slabs, or tiny flakes between 0.1-5000 µm. It is very resistant to degradation and is insoluble in water. Microplastics are widely distributed in the oceans, sediments, land, and consumed by marine organisms such as fish and shellfish. This study aims to describe the presence of microplastics in the faeces of pregnant women. This type of research is an analytic observation with a cross-sectional design. The sample in this study amounted to thirty pregnant women. Data obtained through interviews using a questionnaire and examination of faeces samples. The results showed that all stool samples contained microplastics. The number of microplastics found ranged from 5 to 21 microplastics with the types of fiber, fragments, and films. The length of the microplastics ranges from 0.2 - 4.9 mm. It is concluded that ingested microplastics are disposed of through feces but the residue will accumulate in the body and can pose health risks in the long term. Encouraging the role of the government through education and regulation so that the community obeys and does not throw garbage anywhere.

Keywords: Microplastic, Seafood, Amount, Type, Size.

INTRODUCTION

Plastic has become a global issue due to its continuous growth over time. Plastics come from various products that are initially difficult to decompose by microorganisms and are very resistant to degradation [4]. High population in urban areas are one of the leading causes of the increasing volume of plastic waste [18]. Accumulation, generally in open dumps, is associated with environmental pollution [14]. In terms of manufacture, plastics are dominated by polymers of polystyrene, polyethylene, polypropylene, polyvinyl chloride, and polyethylene terephthalate [20]. The increase of plastic-based materials results in around 360 million tons of microplastic pollution. Asia occupies the world highest production of plastic waste by 51% [21]. It is estimated that more than 5 trillion pieces of plastic float in the oceans worldwide weighing more than 250,000 tons, which is scientifically harmful to aquatic ecosystems.

The long degradation of plastics has resulted in microplastics which are a combination of various types of materials, which can be pieces, fibres, granules, slabs, or tiny flakes between 0.1-5000 µm [11]. The degradation process that occurs by external forces such as wind, ocean currents, and waves causes plastic waste to be fragmented into smaller pieces through weathering, including exposure to UV rays and biodegradation [9]. Plastic waste is widely distributed in water, sediment, fish, shellfish, soil, and even air [13]. Materials that were degraded to microplastics (MPs, < 5 mm) were found as fibres, fragments, films, and nano plastics (NP; particles < 0.1 µm; 100 nm) [26], whereas the size of microplastics presented at sea level, sediments and biota measuring < 1- 1-5 mm [19].

Microplastics are defined as primary and secondary microplastics based on their respective characteristics. Primary microplastics are small plastics that are made in such a way, deliberately added to cosmetic products, cleaning agents, and skin exfoliants, which can enter the environment through sewage treatment plants, ship paints, and building cleaners. Secondary one when it comes from physical and chemical degradation of plastic waste [17].

Microplastics are widespread and ubiquitous in marine habitats from surfaces and coastlines to deep seas. Small pieces can be absorbed by small biota ranging from fish to shellfish, which have the potential to cause damage [27, 10]. The source of pollution is not only from ordinary microplastics, but fish contaminated with fibre also comes from fishing gear/ropes or nets used by fishermen [7]. Micrometre-sized plastics are easier to digest while nanometers can pass through cell membranes [15]. More than 690 contaminated marine species have been detected in their digestive tract and represent possible routes of exposure to humans [5, 24].

Fish is very beneficial for pregnant women and fetal growth. Fish contribute 180 kcal per person per day of energy in food. Fish contains protein, polyunsaturated fatty acids (PUFA), fats (omega-3, fatty acids eicosapentaenoic acid (EPA), docosehexaenoic acid/DHA), some vitamins, and minerals that essential for fetuses and infants neurodevelopment [25].

Various colours, shapes and sizes of microplastics were detected in all fish muscle samples. estimated mean of microplastic intake throgh fish muscles of white shrimp, Grouper, yellow tail fish, and Barracuda consumption was 555, 240, 233, and 169 items/300 g-week. Fish has higher microplastic content in muscles [1]. The density of most microplastics is higher than seawater (1.02 g/cm3) and settles in sediments [2]. The purpose of this study is to describe the presence of microplastics in the faeces of pregnant women.

MATERIALS AND METHODS

Location and research design

This research was conducted in the working area of Public health center Pattingalloang and Jumpandang Baru, Makassar City. The research was conducted from June to August 2020. This type of research is observational descriptive.

Sample

There were thirty pregnant women who were involved in this study. They are pregnant women who visit Public health center Pattingalloang and Jumpandang Baru, Makassar City. They were involved with several inclusion criteria, that is

a. Respondents were pregnant women who visited the Public health center

b. Respondents are domiciled in Makassar City

c. Respondents from the beginning of their pregnancy checked themselves at the Public health center Pattingalloang and Jumpandang Baru

Data collection

The data collection method in this study is an interview with a questionnaire. Examination of stool samples is carried out in the laboratory**.**

Data analysis

The data analysis used in this research is descriptive analytic data analysis, which is to describe the amount of seafood consumed, and the microplastics found in the feces of pregnant women.

RESULTS

Respondent Characteristics

Table-1: Distribution of Pregnant Women based on Characteristics in Pattingalloang Village and Ujung Pandang Village, Makassar City in 2020

Variable	amount	
	n	%
Age (Years)		
20	5	16.7
20 - 30	15	50
30 - 35	5	16.7
35 - 40	4	13.3
40 - 45	1	3.3
Total	**30**	**100**
Gestational Age	**n**	**%**
1st trimester	11	36.7
2nd trimester	17	56.7
3rd trimester	2	6.6
Total	**30**	**100**

Table 1 shows the characteristics of the respondents based on age and gestational age. Most respondents were 20-30 years old (50%), and the lowest was 40-45 years (3.3%). Furthermore, most respondents had a gestational age of the second trimester (56.7%), followed by third-trimester gestation age (6.6%) and first pregnancy age (36.7%).

Microplastics and Seafood Consumption

Table-2: Distribution of Pregnant Women Based on the Amount of Consumption and Type of Seafood Consumed in Pattingalloang and Ujung Pandang Villages, Makassar City in 2020

Variable	Amount	
	n	%
Amount of seafood consumption		
High	13	43.3
Moderate	7	23.3
Low	10	33.3
Total	**30**	**100**
The type of seafood that is often consumed	**n**	**%**
Big fish	5	17
Small fish	18	60
Not Fish	7	23
Total	**30**	**100**
Number of microplastics	**n**	**%**
< 12	18	60
> 12	12	40
Total	**30**	**100**

Table 2 shows the variables of the amount of seafood consumption, the type of seafood and the number of microplastics. More respondents have high seafood consumption (> 12 ounces/mg) in a week (43.3%) than low consumption (33.3%) and moderate consumption (23.3%). The type of seafood most frequently consumed by respondents in a week is small fish (60%), followed by shrimp and squid (23.3%) and big fish (16.7%). The highest number of microplastics found in the feces of pregnant women was < 12 (60%) and > 12 (40%).

DISCUSSION

Microplastics are plastic particles < 5 mm in size found in the feces of pregnant women. One of the causes of microplastics found in the feces of pregnant women is the consumption of seafood contaminated by plastic waste. Micro plastics were found in thirty stool samples ranging from 5-21 microplastics.

Seafood is a significant source of omega-3 fatty acids which are essential for optimal neurodevelopment. However, a study conducted by Avon Longitudinal Study of Parents and Children (ALSPAC) using the longitudinal method suggested that pregnant women should limit their fish intake to only 340 grams every week [12]. This research is in line with recommendations from the FDA EPA that pregnant women consume seafood in a week of between 8 and 12 ounces per week. A study by Avio *et al*. [3] stated that microplastics absorb toxins produced from chemicals in seawater and the surrounding environment and can be transferred into the food chain indirectly. This result is in line with research Rochman et al (2015) [22] found that the accumulation of microplastics in the sediment also make the biota consume microplastics directly. If humans consume contaminated biota, the microplastics will again enter the human body.

The results of research by Rochman *et al*. [22] at the Makassar Paotere fish Auction show that microplastics are found in various types of fish, including Mackerel, Flying fish, Herring, Carangidae and Baronang fish. Research by Devriese *et al*. [6] on shrimp explained that synthetic fibres dominated microplastics with a concentration of 1.23 ± 0.99 microplastics per shrimp. The same thing was also conveyed in the research of Margaretha [16], which identified microplastics in squid samples obtained from markets in Semarang. The results were particles/gram of wet weight found 3.31-3.88 and 0.77-0 microplastics with fibre and fragment types.

Humans are potentially exposed to microplastics through food, drink and air (9). A number of studies have shown that microplastics can pass through the food chain and then enter the human body. Consumption of seafood is one possible pathway for exposure to microplastics in humans [24].

A research by Schwab *et al*. [23] detecting microplastics in human feces found that 8 samples of human faeces were analyzed by FTIR, all containing microplastics ranging in size from 50-500 µm. Most of the microplastics identified were in the form of fragments and films. The results of this study on thirty samples of feces of pregnant women in the working area of Public health center Pattingalloang and Jumpandang Baru found that all samples contained microplastics with sizes ranging from 0.2 - 4.9 mm.

CONCLUSION

Based on the research results, it can be concluded that microplastics were found in all stool samples of pregnant women. Microplastics were found from thirty stool samples ranging from 5-21 microplastics with the types of fibre, fragments and films. The length of the microplastics varies from 0.2 - 4.9 mm. The kinds of seafood consumed by the respondents were large fish (tuna and skipjack), small fish (fly, mackerel and anchovies), and non-fish (squid and shrimp).

Things that need to be done are to change habits by reducing, reusing and recycling plastics gradually by avoiding using or purchasing single-use plastik products in everyday life encouraging the role of government through education and regulation. Carrying out beach clean-up activities can increase public awareness to protect the marine environment by not littering.

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