International Journal of Chemical and Biochemical Sciences
(ISSN 2226-9614)

Journal Home page: www.iscientific.org/Journal.html

Analysis of microplastic exposure risk through Consumption of cakalang fish (*Euthynnus Affinis*) on fish traders in the coastal area tanah beru village, bontobahari district, bulukumba district

Iin Loloangin[1*], Anwar Daud[2], Hasnawati Amqam[3], Agus Bintara Birawida[4], Ansariadi[5], Lalu Muhammad Saleh[6], Anwar Mallongi[7], Setiawan Kasim[8]

[1] Department of Enviromental Health, Faculty of Public Health, Hasanuddin University, 90245 Jl. Tamalanrea, Makassar, Indonesia*
[2,3,4,7,8] Department of Enviromental Health, Faculty of Public Health, Hasanuddin University, 90245 Jl. Tamalanrea, Makassar, Indonesia
[5]Department of Epidemiology, Faculty of Public Health, Hasanuddin University, 90245 Jl. Tamalanrea, Makassar, Indonesia
[6]Department of Occupational Health and Safety, Faculty of Public Health, Hasanuddin University, 90245 Jl. Tamalanrea, Makassar, Indonesia

Abstract

Microplastics are plastics that are broken down into smaller particles. Plastic is the most abundant type of waste found on land and in the sea. This research aims to analyze environmental health due to exposure to microplastics through the consumption of skipjack tuna. The results showed that the average abundance of MPs found in skipjack tuna samples was 1.78 items/g, while the average abundance found in feces samples was 0.022 items/gram. The average daily intake for non-carcinogenic from 5 respondents was 0.0002mg/kg/day while the average daily intake for carcinogenic was 0.0003 mg/kg/day. If the intake rate ≤ RfD then it is still said to be safe. The average risk level for MPs exposure was 0.002. The risk level is said to be no risk if it is expressed as ≤ 1. The type of MPs contained in fish and feces samples is in the form of fragments which have a transparent color in fish samples and a brown color in feces samples. The polymers found in this research are *Polyethylene (PE) and Polystyrene (PS).* This is hereby stated the presence of microplastic contamination in skipjack tuna (*Euthynnus Affinis)* consumed by fish traders in Tanah Beru sub-district, Bontobahari sub-district, Bulukumba Regency.

Keywords: Microplastics, Polymers, Risks Assessment, Fish traders, Polyethylene (PE) and Polystyrene (PS).

Full length article **Corresponding Author*, e-mail: loloanginiin@gmail.com

1. Introduction

Plastic is a term used in many fields to describe the physical properties and behavior of materials (e.g. soil, geological formations), as well as the name of a class of materials. The term 'plastic' is used here to define a sub-category of a larger class of materials called polymers. Polymers are very large molecules that have a long chain-like molecular architecture and therefore a very high average molecular weight [11]. Plastic is one type of waste that is most commonly found on land and sea. Plastic production in the world increases every year reaching 322 million tons [9]. Careless disposal of waste from plastic and plastic products can cause environmental pollution that disturbs aesthetics [1],[2],[3[,[4],[5]. Based on the results of research by [6], which investigated the presence of microplastics in two commercial bivalve species: Mytilus edulis and Crassostrea gigas. A variety of microplastics were detected in human feces, indicating accidental ingestion from different sources in the human diet. From the research results, those most exposed to microplastics are fishermen and fish traders in the market. This illustrates that Microplastics are everywhere in the environment. And microplastic consumption has been described in marine organisms, where microplastic particles can enter the food chain. Bulukumba Regency is one of the areas in South Sulawesi with quite high fisheries potential. One of the largest productions in Bulukumba Regency is Cakalang Fish (*E. related*) which is one of the marine fisheries resources which is categorized as pelagic fish, where the catch of skipjack tuna varies every year. Production of tuna in 2014 was 14.102 tons. [7] From the initial survey conducted by researchers, most of the types of fish sold at PPI, Tanah Beru Village, Bontobahari District, Bulukumba Regency are Cakalang fish. Therefore, the researchers aimed to see the microplastic content in skipjack tuna.

2. Materials and methods

2.1. Research Location and Time

This research was carried out on December 2021 in Tanah Beru Village, Bontobahari District, Bulukumba Regency.

2.2. Types of research

This research uses environmental Health Risk Analysis (ARKL) approach. This approach aims to assess the level of health risk to humans which is used as the dependent variable.

2.3. Population and Sample

The population in this study was skipjack tuna sold at the Fish Landing Center (PPI) and fish traders in Tanah Beru Village, Bontobahari District, Bulukumba Regency. The sample in this study used methods *purposive sampling* namely skipjack tuna taken from traders who sell skipjack tuna by taking 1 fish at random from each seller. Drawing the number of fish samples using techniques*random sampling* with the criteria for fish size in the small category of 20-60 cm. determining fecal samples using inclusion criteria, namely all fish sellers domiciled in Bontobahari sub-district with an age range of 17-50 years who consume skipjack tuna *Euthynnus Affinis*

2.4. Data collection

The data sources used in this research use primary data and secondary data, primary data was obtained directly through observation and interviews using questionnaires, identification of microplastics using a microscope and *spectroscopy,* and Environmental health risk analysis (ARKL). Secondary data comes from demographic data for Tanah Beru Village.

2.5. Data Collection Technique s

The data in this study used a questionnaire to obtain information related to fish consumption levels with the aim of knowing the rate of activity namely intake rate, frequency of exposure, duration of exposure and anthropometry.

2.6. Data analysis

Analysis of polymer type microplastics obtained from the identification results is processed using the environmental health risk analysis (ARKL) formula to determine the magnitude of the health risk caused by exposure to microplastics in the human body.

3. Results

Table 1 shows that the average abundance of MPs found in skipjack tuna samples was 1.78. Table 2 shows the average abundance of microplastics (MPs) found in the feces of 5 respondents was 0.022 items/gram. Table 3 shows that the average daily intake for non-carcinogenic from 5 respondents is 0,0002 mg/kg/day, while the average daily intake for carcinogenic is 0,0003 mg/kg/day. If *intake rate* ≤ RfD (*Reeference Dose)* then it is still said to be SAFE, otherwise if *Intake Rate* ≥ RfD (*Raference Dose)* then it is said to be UNSAFE. Meanwhile, the RfD on microplastics has not been determined by the EPA, so the RfD used in this research is the RfD value of the polymer *Polystyrene (PS)* composed of polymers *Styrene* namely 0,2 mg/kg/day. When referring to the Rf D value of polymers*styrene* then the non-carcinogenic daily intake value is 0,0002 ≤ 0,2 so it can be said to be still safe. Meanwhile, the carcinogenic daily intake value is 0,0003 ≤ 0,2 so it can be said to be still safe. The results of FTIR analysis of microplastics in fish and feces are displayed in the form of a wave spectrum.The wave spectrum shows a sharp and strong absorption band at the wave number 1713,15 cm^{-1} shows the functional group C=O. The existence of a wave number of 1240,80 cm^{-1} comes from the C-H functional group. Followed by the wave number 1090,91 which comes from the C-O carbonyl group. The results of identifying functional groups in fish samples when connected to polymers, it is likely that the samples contain *Polyetelena (PE)*. The wave spectrum shows a sharp and strong absorption band at the wave number 2916,06 cm^{-1} indicates the C-H functional group. Wave number 2848 cm^{-1} comes from the C-H functional group. Ends with the wave number 718,57 with the C-H functional group. Based on this data, if it is related to polymers, it is likely that the sample contains polymers *Polystyrene (PS).*

4. Discussion

Microplastics found in fish samples in Tanah Beru sub-district, Bontobahari sub-district, indicate the occurrence of plastic waste pollution around the sea in the coastal area of Tanah Beru Village. Based on the survey results, it was seen that residents of the Bontobahari coastal area were throwing plastic waste into the sea, especially fish auction activities at PPI Tanah Beru. These plastics are carried by currents out to sea and are degraded by sunlight so that they break down into plastic debris which is then consumed by marine biota. This is in accordance with [9] statement that aquatic organisms can be contaminated by microplastics either through loaded water or food from other organisms that contain microplastics. The abundance of microplastics in fish in this study showed an average of 1.78 ± 1.2 items/individual. The microplastics found were only fragments. Compared with other studies, [8] found microplastics in mackerel, flying fish, herring, fish of various types *Carangidae*and also rabbitfish with an average number of microplastics of 5,9 ± 5,1 items/individual. The microplastics found in the digestive tract of this fish come in the form of films, Styrofoam and monofilament. Besides, [15] found the average abundance of microplastics in fish stomach samples was 1,96 ± 1,12 items/individual and 1,53 ± 1,08 items/g and Digka, [10] also found that the average abundance of microplastics in fish bodies was 1.5 items/individual. The amount of microplastics found in human fecal samples varies. This is thought to be because human exposure to microplastics comes from many sources. The type of microplastic found in human feces is in the form of fragments. Fragments are a form of microplastic that has a slightly harder texture than other forms of MPs. The fragment form is quite easy to find in the sample solution because of its rather solid shape and striking color. Fragments were also found in fish samples. The fragments found in the identification of MPs in human feces have the same color, namely brown.

Table 1: Data on the Abundance of Microplastics (MPs) in Fish

No	Abundance of Mps	Minimum	Maximum	Rata-Rata ± SD
1	Abundance (items/g)	0	3.22	1.78 ± 1.2
2	Amount	0	5	2.4 ± 1.67

Source: Personal data processing, 2023

Table 2: Data on the Abundance of Microplastics (MPs) in Feces

No	Abundance of Mps	Minimum	Maximum	Rata-rata± SD
1	Abundance (items/g DW)	0	0.06	0.022 ± 0.024
2	Quantity (items/individuals)	0	5	1.60 ± 1.67

Source: Personal data processing, 2023

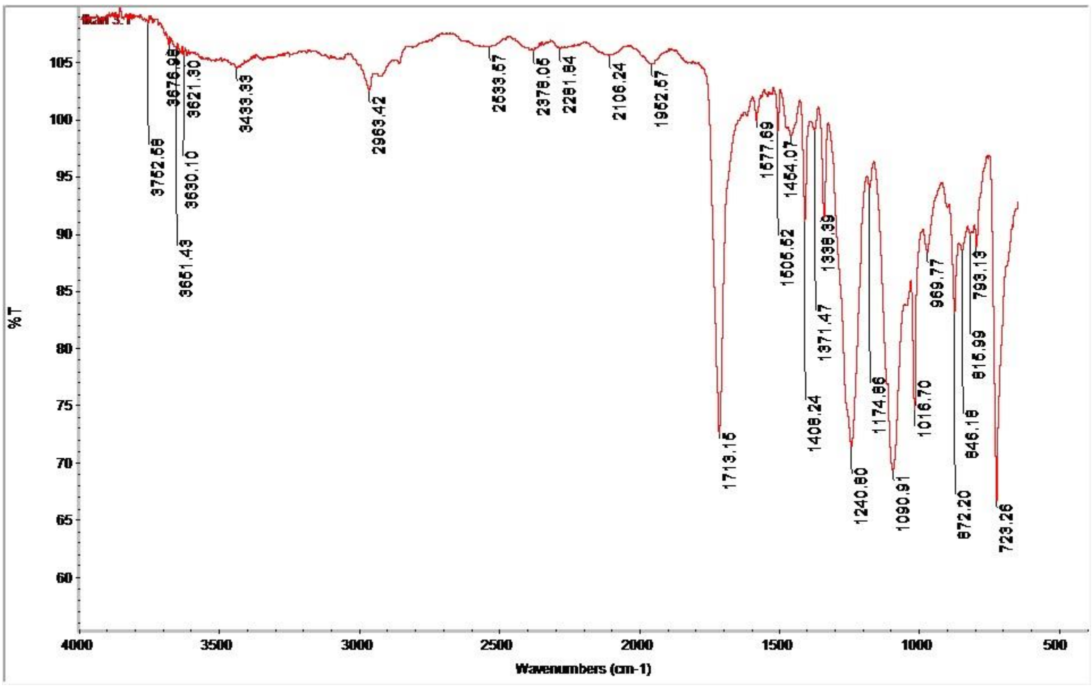

Figure 1. Results of examining the types of microplastic polymers in fish samples

Table 3: Interpretation of Daily Intake Calculation Results (*Intake)* Microplastics (MPs)

No	Daily Intake (mm/kg/day)	Min	Max	Rata2 SD
1	Non Carcinogenic Intake	0,0001	0,0003	0,0002 ± 0,0001
2	Carcinogenic Intake	0,0004	0,009	0,0003 ± 0,0004

Source: Personal data processing, 2023

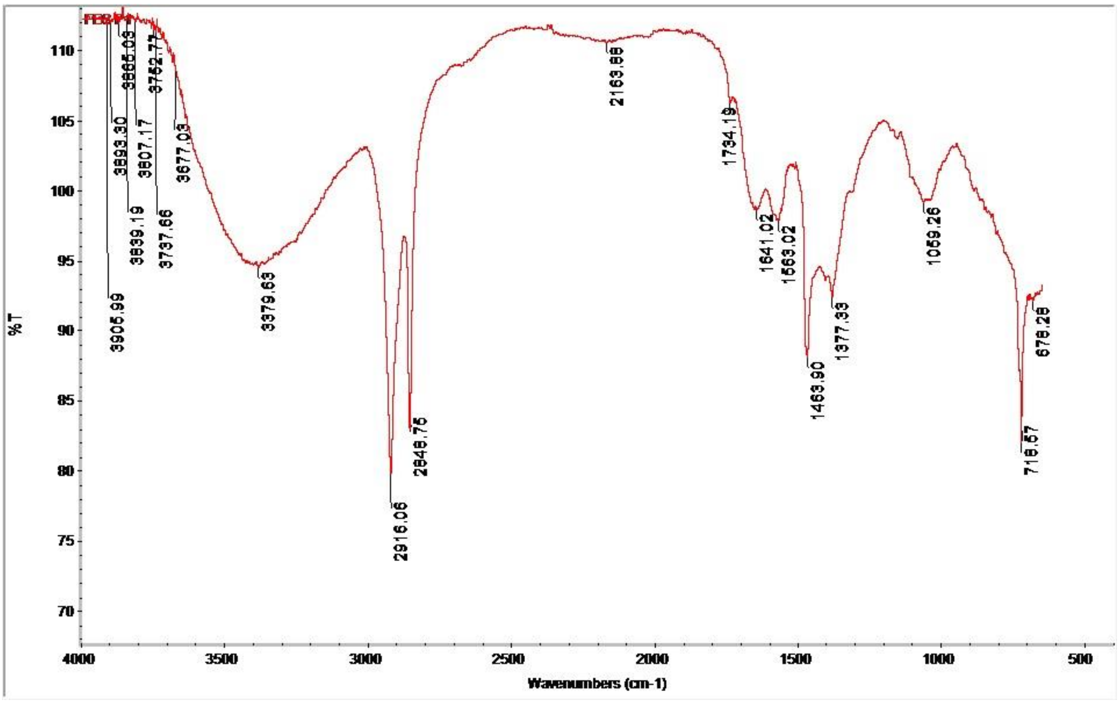

Fig 2: Results of examination of microplastic polymer types in fecal samples

The average number of microplastics found in fish samples showed an average of 0.022 items/g dry weight. The positive type of polymer found in this study was*Polystyrene (PS), dan polyethylene (PE). Polistirene* is a polymer with styrene monomer whereas*polyethylene (PE)* is a polymer that has quite wide applications, especially as packaging containers, such as food packaging containers, plastic bags, baby bottles, facial cleansing gel bottles, packaging foam, plastic bowls, Ziploc bags [13].

5. Conclusions and Recommendations

Based on the research results, the researcher concluded that the presence of microplastic contamination in skipjack tuna (*Euthynnus Affinis)* consumed by fish traders in Tanah Beru sub-district, Bontobahari sub-district, Bulukumba Regency. Recommended to maintain consumption patterns of microplastics that enter the human body, for example: minimizing the use of food packaging or food containers made from plastic.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

The authors declare no conflict of interest.

References

[1] A.L. Andrady. (2015). Persistence of plastic litter in the oceans. *Marine anthropogenic litter*, pp.57-72.

[2] A.L. Andrady. (2003). Plastics in the environment. In: Andrady, A.L., (Ed.), Plastic in the environment. John Wiley & Sons, New jersey, NJ, p.762

[3] O.A. Alabi, K.I. Ologbonjaye, O. Awosolu and O.E. Alalade. (2019). Public and environmental health effects of plastic wastes disposal: a review. Journal of Toxicology and Risk Assessment. 5(21): 1-13.

[4] G.J. Hofmeyr, S. Ferreira, V.C. Nikodem, L. Mangesi, M. Singata, Z. Jafta, B. Maholwana, Z. Mlokoti, G. Walraven and A.M. Gülmezoglu. (2004). Misoprostol for treating postpartum haemorrhage: a randomized controlled trial [ISRCTN72263357]. BMC pregnancy and childbirth, 4, pp.1-7.

[5] D. Lithner, J. Damberg, G. Dave and A. Larsson. (2009). Leachates from Plastic Consumer Product – Screening for Toxicity with Daphnia magna. Chemosphere. 74(9) 1195-1200.

[6] L. Van Cauwenberghe, C.R. Janssen. (2014). Microplastics in bivalves cultured for human consumption. Environmental pollution. 193:65-70.

[7] Central Statistics Agency. (2016). Bulukumba Regency in Figures and fisheris Data for 2014. Bulukumba Regency Central Statistics Agency https://bulukumbakab.bps.go.id/subject/56/perikanan.html#subjekViewTab1

[8] M.R. Cordova. (2020). Marine plastic debris: distribution, abundance, and impact on our seafood. In *Handbook of Research on Environmental and Human Health Impacts of Plastic Pollution* (pp. 94-121). IGI Global.

[9] A. Daud, H. Ishak. (2019). Environmental Health Contemporer. Gosyen Publishing. Yogyakarta: No 098/DIY/2017. xvi, pp. 513.

[10] N. Digka, C. Tsangaris, M. Torre, A. Anastasopoulou, C. Zeri. (2018). Microplastics in mussels and fish from the Northern Ionian Sea. Marine Pollution Bulletin. 135: 30-40.

[11] GESAMP. (2015). Sources, fate and effects of microplastics in the marine environment: a global assessment. International Maritime Organisation: pp. 1-69.

[12] C.M. Rochman, A. Tahir, S.L. Williams, D.V. Baxa, R. Lam, J.T. Miller, F.-C. Teh, S. Werorilangi, S.J. Teh. (2015). Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption. Scientific reports. 5(1): 1-10.

[13] U. EPS. (1989). Exposure factors handbook. Office of Health and Environmental Assessment. EPA/600/8-89/43.

[14] B. Widianarko, I. Hantoro. (2018). Microplastic in seafood from the north coast of Java. Soegijapranata Catholic University, Semarang.

[15] L. Zhu, H. Wang, B. Chen, X. Sun, K. Qu, B. Xia. (2019). Microplastic ingestion in deep-sea fish from the South China Sea. Science of the Total Environment. 677: 493-501. https://doi.org/10.1016/j.scitotenv.2019.04.380