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Healthy lifestyles mitigate heavy metal accumulation in fishermen from Indonesia

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Abstract. This study examined the levels of Cadmium (Cd) and Chromium (Cr) in the urine of fishermen from Junganyar Pesisir Village, Socah District, Bangkalan Regency, and explored their relationship with age. Using Atomic Absorption Spectrophotometry (AAS), urine samples from 16 fishermen were analyzed. Results showed Cd levels below 0.01 mg/L and Cr levels ranging from 0.24 to 1.8 mg/L. No significant correlation was found between metal levels and age ($p > 0.05$), likely due to the fishermen's healthy lifestyle, which reduces metal accumulation and enhances excretion. The study, conducted in August-September 2022, emphasizes the role of lifestyle in mitigating heavy metal exposure..

Highlights:

1. **Method:** Used Atomic Absorption Spectrophotometry (AAS) for urine analysis.
2. **Results:** Cd < 0.01 mg/L; Cr 0.24-1.8 mg/L; no age correlation.
3. **Implication:** Healthy lifestyle reduces heavy metal accumulation and enhances excretion**..**

Keywords: Cadmium, Chromium, Fishermen, Urine Analysis, Heavy Metal Exposure

Introduction

Indonesia consists of a group of large and small islands and coastal areas which are potential sources of food, media, transportation services, which have high potential and transportation services, security protection and destinations. tourism profitable. Activity humans in use resource, industry, fishery, mining, tourist And etc. Production Excessive waste and endangering aquatic and marine life can have an impact environmental damage or degradation of environmental quality like pollution Which impact to decline quality water [1] .

Marine pollution as a negative impact on biota, natural resources, comfort of marine ecosystems, and human health, which are directly or indirectly caused by the release of waste into the sea from human activities, including activities on ships at sea, pollution or the addition of something that disturbs the balance of the environment, endangers the life of organisms and reduce water use [2] . Problem main thing faced

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by creatures life other is source water power includes quantity of water already No capable fulfil urgent need improved and water quality for needs increasingly domestic decrease . One of factor main reason decline water quality ie originate from activity industrial , domestic , and B3 waste , namely metal heavy [3] .

Heavy metals are metallic elements that have a density of >5 g/cm 3 in seawater, heavy metals are found in dissolved and suspended form. Under natural conditions, heavy metals are also needed by organisms for growth and development [4] . Metal heavy consists from two group . First , nature non essential metal with concentration low and not yet is known the benefits for body such as (Pb, Cd and Hg), secondly , nature essential metals required by organisms life in amount certain ones that work in growth and development cells body as well as biochemical processes , for example namely (Cu, Zn and Cr) [5] .

Urine is the remaining material excreted by the kidneys and collected in the urinary tract and excreted by the body through the process of urination . The filtered urine excreted from the kidneys to the ureters is then stored in the bladder and then excreted. This process is needed to remove waste molecules from the blood that are not needed by the body to maintain fluid balance . Substances contained in urine can know condition general inside body . Degrees production from various units functional in The body can be known from the levels of various substances in the urine [6] .

The SSA (Atomic Absorption Spectrophotometer) method is based on the absorption of light by atoms. Atoms absorb this light at different wavelengths certain, depends on type the elements. Principle base absorption spectrophotometer atom is interaction between radiation electromagnetic and samples . Atomic absorption spectrophotometer is a very accurate method for analyzing substances in low concentrations [7] .

Based on study previously concentration results using the SSA method for lead (Pb) values below the threshold of 0.15 mg/l and cadmium (Cd) below the threshold of 0.01 mg/l and the results of the Pearson correlation test for metal lead (Pb) and cadmium (Cd) sig value. < 0.05, so Ha is accepted and it is said that there is a relationship between heavy metals in urine with age [8] .

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Based on research Previously , the average value of the heavy metal chromium (Cr) at SPBU X was 0.024 mg/g And on Gas Station Y is 0.051 mg/g whereas rate average Fe metal at gas station X is 0.464 mg/g and at gas station Y is 0.345 mg/g [7] .

Based on study previously The results were analyzed using a parametric correlation test which can be explained that there is a relationship between the levels of the heavy metals Copper (Cu) and Cadmium (Cd) and the length of service, namely (p=0.000). Obtained very weak correlation results between heavy metal content and mass Work [9] .

Based on research previously The results showed that the highest levels of lead (Pb) at the two gas stations were 0.013 mg/g and 0.026 mg/g. The lowest levels of lead (Pb) were -0.03 mg/g and -0.001 mg/g. The highest cadmium (Cd) levels at the two gas stations were 0.003 mg/g and -0.001 mg/g. The lowest cadmium (Cd) levels are 0.000 mg/g and -0.003 mg/g. These results are below the metal content limit inside the body. The person correlation value for Pb metal is 0.213 (positive value and weak correlation category) with a significance (2-tailed) of 0.368. Meanwhile, for Cd metal, the person correlation value was -0.013 (negative value and very weak correlation category) with a significance (2-tailed) of 0.957 [1 0].

Method

This research has received Ethical Clearance from the committee ethics STIKes Ngudia Husada Madura and was declared ethically fit with Number 1496/KEPK/STKES-NHM/EC/X/2022 . The type of research used is quantitative with a laboratory experimental research design. Carried out in the Village Jungayar Pesisir , Basic Chemical Technology Laboratory Laboratory Medical Muhammadiyah University of Sidoarjo and the Chemistry Laboratory of FMIPA, Maulana Malik Ibrahim Islamic University , Malang in August until September 2022 . The sample for this research was 16 fishermen in the village Junganyar Coastal Subdistrict Socah Regency Bangkalan . The sampling technique used in this research was purposive random sampling (a sampling technique taking into account certain criteria) . The tools needed for this research are sample bottles, 100ml measuring flasks, hot plates, beakers, filter paper labels, measuring pipettes, dropper pipettes, stirrers, test tubes, atomic absorption spectrophotometer (SSA). The materials used include i: urine samples from fishermen in Junganyar Pesisir village, Nitric acid

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(HNO 3), distilled water. Data from results research is analyzed using SPSS 16 with normality test , homogeneity test , and correlation test Pearson

Discussion

Table 1. Data Distribution Category Age Respondent

Age (th)	Number (n)	Percentage %
36- 41	2	12.5
42- 45	1	6.25
46- 49	5	31.25
50- 53	2	12.5
54 or more	6	37.5
Total	16	100

Based on Table 1 there are 2 Fishermen aged between 36-41 years with a percentage of 12.5%, 1 Fisherman aged between 42-45 years with a percentage of 6.25%, 5 Fishermen who aged between 46-49 year with percentage 31.25% 2 fishermen aged 50-53 years with a percentage of 12.5% and 6 fishermen aged between 54 years or more with a percentage of 37.5% of the total 16 fishermen respondents in Junganyar Pesisir Village, Socah District, Bangkalan Regency.

Table 2 . Data Distribution Category Years of service Respondent

Period Work (th)	Number (n)	Percentage %
5- 12	1	6.25
13- 20	4	25
21- 28	4	25
29- 36	4	25
37 or more	3	18.75
Total	16	100

Based on Table 2 shows that the working period of fishermen in Junganyar Pesisir Village, Socah District, Bangkalan Regency, with a working period of between 5-12 years, there is only 1 Fisherman with a percentage of 6.25%, and a working period of between

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13-20 years is 4 Fishermen with a percentage of 25%. , and a work period of 21-28 years as many as 4 fishermen with a percentage of 25%, while a work period of 37 years or more than 3 fishermen with a percentage of 18.75% of the total respondents.

. **Table 3 .** Data Distribution Category Length of working Respondent

Long Work (O'clock)	Number (n)	Percentage %
5- 6	4	25
7- 8	9	56.25
9 or more	3	18.75
Total	16	100

Based on Table 3 shows the distribution of the length of work of fishermen in Junganyar Pesisir Village, Socah District, Bangkalan Regency, who have a work time of between 5-6 hours, as many as 4 fishermen with a percentage of 25%, and for fishermen who have a work time of between 7-8 hours, there are 9 fishermen with percentage of 56.25%, while for The fishermen own length of work 9 O'clock or more as much 3 fishermen from the total number of respondents .

Table 4 . Data Distribution Category Smokers and Not Smoker

Smoker	Number (n)	Percentage %
Yes	8	50
No	8	50
Total	16	100

Based on Table 4 shows that the average number of respondents is 8 fishermen who smoke or who do not smoke with a percentage of 50%.

Table 5 . Data Distribution Category Respondents ' Health Complaints

Amount Stem Cigarette	Number (n)	Percentage %
5- 10	2	25
>10	6	75
Total	8	100

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Based on Table 5 is obtained from the number of smoking respondents, namely 8 fishermen, there are fishermen who consume 5-10 cigarettes in a day with percentage 25%, 6 person The fishermen smoke >10 cigarettes a day with a percentage of 75%.

Table 6 . Data Distribution Category Amount Consumption Cigarette

Complaint Health	Number (n)	Percentage %
Fatigue	15	45.4
Hands/feet weak	2	6.5
Sick head	3	9.1
Blurred vision	7	21
Nauseous	-	-
Disturbance Sleep continously	1	3
Pain in bone	5	15
Congested breath	-	-
Total	33	100

Based on Table 6 shows data on health complaints among fishermen in Junganyar Pesisir Village, Socah District, Bangkalan Regency, the most common complaint is fatigue. there were 15 people with a percentage of 45.4%, and the health complaints that were not complained about by many were sleep disorders at 3%. For visual complaints blurry happen on 1 fisherman age 43 year, 2 fisherman age 49 years old, 1 fisherman aged 58 years and 3 fishermen aged 60 years, while complaints of bone pain occurred in 1 fisherman aged 38 years, 1 fisherman aged 55 years, 1 fisherman aged 58 years, and 2 fishermen aged 60 years old.

A. Curve CD standard

Testing on the Standard Curve is carried out by measuring the absorbance of a Cadmium (Cd) standard series solution. The standard series or concentration of the standard solution made is 0.0; 0.2; 0.4; 0.6 and 0.8 mg/L. Then the standard solution data is obtained :

Table 7 . Data Solution Cadmium (Cd) Standard

Sample	Concentration (mg/L)	Absorbance (Abs)

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Blank	0,000	- 0.0017
Standard 1	0.200	0.1344
Standard 2	0.400	0.257
Standard 3	0.600	0.3776
Standard 4	0.800	0.5302

Data obtained in Table . 7 A standard curve is used to determine the concentration of a substance in an unknown sample by comparing a standard sample of known concentration. Meanwhile, regression values are used for the influence between two or many variables.

B. Curve Cr Standard

Testing on the standard curve is carried out by measuring the absorbance of the solution standard series Chromium (Cr). Row standard or concentration solution The standard created is 0.0; 0.5; 1.0; 1.5 and 2.0 mg/L then standard solution data was obtained .

Table 8 . Data Solution Standard Chromium (Cr)

Sample	Concentration (mg/L)	Absorbance (Abs)
Blank	0,000	0.0008
Standard 1	0.500	0.0091
Standard 2	1,000	0.0157
Standard 3	1,500	0.0257
Standard 4	2,000	0.0337

Data obtained in Table . 8 A standard curve is used to determine the concentration of a substance in an unknown sample by comparing a standard sample of known concentration. Meanwhile, regression values are used for the influence between two or many variables.

C. Measurement of Cadmium (Cd) and Chromium (Cr) Metal Levels Using an Atomic Absorption Spectrophotometer (ASA).

The levels of heavy metals Cadmium (Cd) and Chromium (Cr) in urine were measured with use method Spectrophotometer Absorption Atom (SSA) with a wavelength for the examination used, namely 228.8 nm for measurement Cadmium (CD) And 357.9 nm For Chromium measurement (Cr).

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1. Cadmium (Cd) Level Results

Table 9 . Results of Measurement of Cadmium (Cd) Levels Using an Atomic Absorption Spectrophotometer (ASA)

No	Sample	Age (years)	Cd levels
1.	A	40	- 0.005
2.	B	60	- 0.004
3.	C	58	- 0.008
4.	D	48	- 0.004
5.	E	38	- 0.015
6.	F	58	- 0.003
7.	G	60	- 0.001
8.	H	49	- 0.007
9.	I	55	- 0.005
10.	J	45	- 0.004
11.	K	49	- 0.010
12.	L	52	- 0.002
13.	M	53	- 0.005
14.	N	60	- 0.004
15.	O	43	- 0.002
16.	P	47	- 0.002
Average			- 0.079125

Cadmium (Cd) levels in urine in Junganyar Pesisir Village, Socah District, Bangkalan Regency based on age are below the threshold of 0.01 mg/L. Cadmium is a dangerous heavy metal and has toxic properties. Cadmium can be produced from various human activities, whether intentionally or unintentionally. Cadmium in the body accumulates in the kidneys and liver, in the kidney cells Cadmium is excreted in the urine. Cadmium levels in respondents can be determined by analyzing the results of urine, blood or hair. The results that influence Cadmium (Cd) levels in the body are individual factors and

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work factors. The atomic absorption spectrophotometer (SSA) showed results that were not detected by the tool, so it can be said that the Cadmium (Cd) content in the Fisherman's urine sample was still below the maximum limit and was not detected by the tool. The non-detection of Cadmium metal content in urine is probably due to levels The cadmium metal contained is very small, so it is not detected [11] .

2. Chromium (Cr) Level Results

Table 9 . Results of Measurement of C romium (C r) Levels Using an Atomic Absorption Spectrophotometer (ASA)

No	Sample	Age (years)	Cd levels
1.	A	40	- 0.040
2.	B	60	0.162
3.	C	58	- 0.016
4.	D	48	0.031
5.	E	38	0.001
6.	F	58	0.049
7.	G	60	0.115
8.	H	49	0.025
9.	I	55	- 0.010
10.	J	45	- 0.034
11.	K	49	0.072
12.	L	52	0.126
13.	M	53	0.028
14.	N	60	0.203
15.	O	43	0.060
16.	P	47	0.013
Average			0.61081
		25	

Chromium (Cr) levels in the urine of fishermen in Junganyar Pesisir Village, District Socah Regency Bangkalan based on Age in lower threshold limit 0.24 – 1.8 mg/L. The heavy metal chromium in waters comes from deep nature amount Which very small like process weathering rock And run-off from land, but the heavy metal chromium can

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increase in large amounts due to human activities such as industrial activities, household waste and other activities through waste that enters the water. Entry pollutants into the waters will affect water quality and organisms [12] .

Based on research Previously , the average value of the heavy metal chromium (Cr) at SPBU X was 0.024 mg/g And on Gas Station Y is 0.051 mg/g whereas rate average Fe metal at gas station X is 0.464 mg/g and at gas station Y is 0.345 mg/g [13] .

Based on results data analysis using SPSS, normality test using the Shapiro-Wilk test because amount insufficient sample of 50, the results obtained Cadmium (CD) as big as 0.004 ($P<0.05$) rate Chromium (Cr) as big as 0.170 ($P>0.05$) and age of 0.911 . So it can be interpreted that the normality test value for Cadmium levels is abnormally distributed, while Chromium levels are normally distributed. After that, a Spearman correlation test was carried out on Cadium levels (cd) to determine the relationship between Cadmium levels and the age of fishermen in Junganyar Village Coastal District Socah Regency Bangkalan. The r value (calculated) is 0.220 and the r value (table) is 0.497 with a sig value of 0.413 ($P<0.05$) so that Ho is accepted, this shows that there is no relationship between Cadmium (Cd) levels and the age of fishermen in Junganyar Pesisir Village, District Socah, Bangkalan Regency.

The normal distribution test was followed by the Pearson correlation test on Chromium (Cr) levels to determine the relationship between Cadmium levels and the age of fishermen in Junganyar Pesisir Village, Socah District, Bangkalan Regency. It was found that the Pearson Correlation r (calculated) value was -0.108, while r (table) was 0.497 with a P value>0.05. So Ho is accepted, this shows that there is no relationship between Chromium (Cr) levels and the age of fishermen in Junganyar Pesisir Village, Socah District, Bangkalan Regency.

Chromium (Cr) metal dissolved in water is very dangerous for living organisms in it. This is because heavy metals are bioaccumulative, that is, heavy metals collect and increase in levels in the body tissues of living organisms, even though the levels of heavy metals in water low but can be absorbed by the body of the organism [14] . This can happen because the response is not very good contact with sea water and most likely the respondent has a healthy lifestyle when at home, such as consuming enough water, vegetables and fruit. This can reduce the accumulation of Cadmium and Chromium levels and can be expressed by the kidneys through urine [15].

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Conclusion

Based on the results obtained in this research, it can be concluded that no there is connection between Cadmium (Cd) and Chromium (Cr) levels with age fishermen in the village junganyar coast subdistrict socah regency Bangkalan . Factor main caused Because fishermen who become respondents own pattern good life , p This can make accumulation Cadmium and Chromium levels reduce so that can expressed kidney through urine . Test results correlation show significant value ($p > 0.05$).

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