Journal of Biological Science and Education
~JBSE~
Website: http://usnsj.com/index.php/biology
Email: biologi_jbse@usn.ac.id

The Effect of The Covid-19 Pandemic on The Amount of Waste at The Toisapu Final Processing Site (TPA) Ambon City, Maluku Province

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ARTICLE INFO

E-ISSN: 2721-0804
P-ISSN: 2723-6838
Vol. 4, No. 1, June 2022
URL: http://usnsj.com/index.php/biology

Suggestion for the Citation and Bibliography
Citation in Text:
Mutmainnah, H. & Pandiangan, F.A. (2022)
Bibliography:
Mutmainnah, H. & Pandiangan, F.A. (2022). The Effect of The Covid-19 Pandemic on The Amount of Waste at The Toisapu Final Processing Site (TPA) Ambon City, Maluku Province. *Journal of Biological Science and Education, 4*(1), 39-46.

Abstract

The massive Covid-19 pandemic has caused countries to implement policies in the form of social restrictions to limit activities outside and only carry out activities indoors. The risk of contracting the Covid-19 virus causes a reduction in public activities in the form of commercial, institutional, and public service facilities. This has an impact on the amount of waste generated by people in urban areas during the pandemic. Therefore, this study aims to determine the effect of covid-19 on the amount of waste that enters the Toisapu TPS in Ambon city and to see the difference in the average amount of waste before the pandemic and during the COVID-19 pandemic with Paired Sample T Test analysis using IBM SPSS statistics 25 application. The results showed that there was a correlation between the two variables (0.693) which means that the correlation of the amount of waste entering the Toisapu TPS between before and during covid-19 was strong but not significant as indicated by the probability value (sig.) 0.013 > 0.05. While the calculated t value is 3.16 > 2.63 (t table value) so it can be concluded that the average amount of waste before and during the Covid-19 period is different.

Keywords: Pandemic, waste, T test

A. Introduction

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov-2) is also known as the coronavirus, a new variant of the coronavirus that is thought to be transmitted by animals to humans. The World Health Organization (WHO) named the disease caused by this coronavirus Covid-19 because this disease was detected for the first time in the city of Wuhan, China, in December 2019. This virus is spreading rapidly in China and several countries, including Indonesia. The swift spread of Covid-19 has encouraged various governments to implement health protocols in preventing Covid-19 as recommended by WHO, including in Indonesia (Suranto, 2020).

The massive spread of COVID-19 has caused this pandemic to be declared a global pandemic and affects all living things on earth. The very fast spread of Covid-19 in almost all countries in

the world has caused many countries to implement lockdown policies which are restrictions on social activities to limit people from doing activities outside the home and only indoors. The implementation of the lockdown policy also occurred in Indonesia, known as PSBB (Large-Scale Social Restrictions). This policy causes people to be more active in their homes. People's activities at home produce domestic solid waste and toxic and hazardous wastes, which are used to protect themselves from the Covid-19 outbreak, such as sanitizers, antiseptics, disinfectants, masks, gloves, face coverings, and other personal protective equipment (Hardi & Akbar, 2021).

According to Ruslinda *et al*. (2021), the implementation of PSBB impacts the amount of waste that goes to the Final Processing Site (TPA). In Ambon City, the Toisapu TPA is the only final waste processing site that receives all Ambon city waste from five sub-districts, namely Sirimau District, Ambon Baguala Bay, Ambon Bay, Nusaniwe and South Leitimur. From the amount of waste that goes to the Toisapu TPA, the total volume of waste in 2019 was 1,958.60 tons, and in 2020 it was 2,084,000 tons (Hardi & Akbar, 2021). Based on the description above, the researcher wants to know the effect of the Covid-19 pandemic on the amount of waste at the Toisapu TPS, Ambon City, Maluku Province and as information to stakeholders for making policies to waste management during the pandemic.

B. Literature Review

1. Covid-19 Pandemi

Covid-19 spreads very quickly because transmission occurs through contact between humans and is transmitted through the mouth, nose and eyes. The swift and deadly spread of Covid-19 has caused the government and religious organizations to try to break the chain of transmission of Covid-19. Several efforts have been made, among others, by applying several rules to be obeyed by the community, including the PSBB policy carried out in each region in Indonesia. The following is a map of the spread of Covid-19 in Indonesia from April 2020 to December 2021 (Covid19.go.id, 2021).

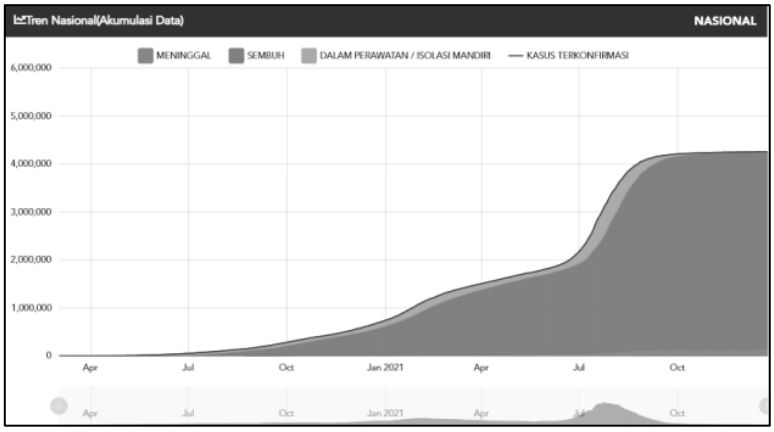

Figure 1. National Trend of Accumulating Covid-19 Data in Indonesia
Source: https://covid19.go.id/peta-sebaran

2. Community behavior during the pandemic

The entry of the Covid-19 virus into Indonesia, especially in the city of Ambon and the increasing number of cases of Covid-19 infection nationally caused the Ambon city government to approve Perwali Number 19 of 2020 (Amendment to Ambon City Mayor Regulation Number 18 of 2020) which stipulated PSBB rules as an effort to handle the outbreak. Corona virus in Ambon city (Ambon Mayor Regulations, 2020).

The risk of contracting the COVID-19 virus has increased public health awareness, thereby changing behavior to become more hygienic. This has also changed people's behavior, such as using personal protective equipment (PPE), shopping for goods and food online using plastic packaging, and using other single-use devices. Changes in people's behavior during the Covid-19 pandemic due to restrictions on community activities impact the amount of waste produced by a city (Ruslinda *et al.*, 2021).

3. Garbage

Garbage is waste material or remnants of human, animal and plant activities that are no longer needed and are considered useless. This waste can be in the form of liquid, gas or solid

(Suhada & Almahdy, 2018). In big cities in Indonesia, the composition of waste in landfills is still dominated by organic waste, as shown in Figure 1. (Sipsn.menlhk.go.id, 2021a).

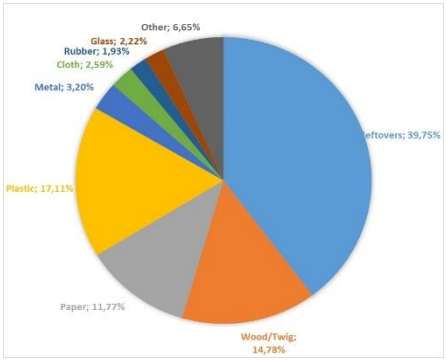

Figure 2. Composition of waste in Indonesia by type of waste
Source: https://sipsn.menlhk.go.id/sipsn/public/data/komposisi

TPA Toisapu is the only active TPA in Ambon city, located in Ama Ory Hamlet, Toisapu, South Leitimur. The local government currently manages TPA Toisapu with a land area of 6 hectares and an active landfill area of 21,700 m2. This TPA receives waste from five sub-districts in Ambon city, namely Sirimau District, Ambon Baguala Bay, Ambon Bay, Nusaniwe and South Leitimur, covering 50 villages in 2019 (Ambonkota.bps.go.id, 2020). The recording of the volume of waste entering the TPA is carried out using a weighbridge and an excel computer (excel/not automatic), where the closure of active waste areas is carried out every seven days or once a week (Sipsn.menlhk.go.id, 2021b).

From 2019 to 2020, landfill waste is dominated by food waste, as shown in the following figure 3.

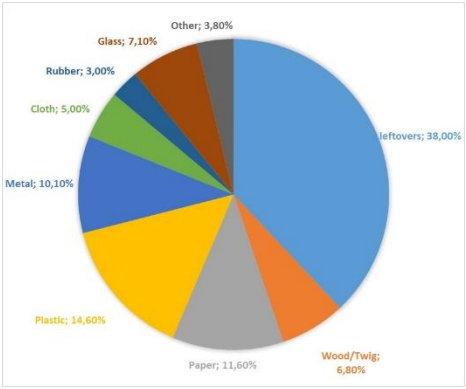

Figure 3. Composition of waste by type of waste in Ambon City, Maluku Province in 2019
Source: https://sipsn.menlhk.go.id

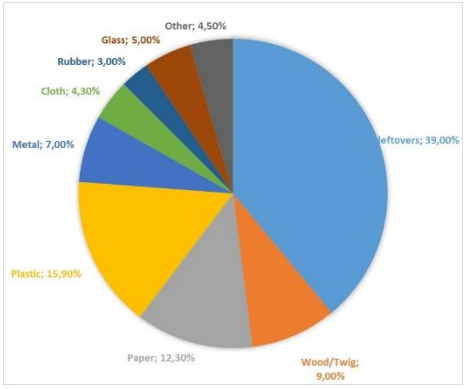

Figure 4. Composition of waste by type of waste in Ambon City, Maluku Province in 2020
Source: https://sipsn.menlhk.go.id

The higher the population density, the higher the activities that impact increasing the amount of waste produced by Ambon City residents. This directly impacts the volume of waste in the Toisapu TPA, which is the only TPA in Ambon City. Data from the Office of Hygiene and the City of Ambon shows that the amount of waste generated by the community in Ambon City has increased along with population growth, from 556 m/month in 2012 to 690.22 m/month in 2013 (Ruban *et al*., 2015).

Population growth and economic growth in an area affect the amount of waste produced. This is because every citizen makes waste in their daily activities. In addition, human consumption patterns and technological advances have also created an increasingly diverse variety of waste, including plastic waste, which is toxic and difficult to decompose naturally. (Rahman, 2013).

C. Methodology

1. Research Desain

This type of research is a quantitative study that identifies the effect of the pandemic on the amount of waste in the Toisapu TPA.

2. Instruments

The research stages started with primary and secondary data collection and then continued with data processing and analysis using the IBM Statistics SPSS 25 application. Primary data was obtained directly through interviews with related parties and data on the amount of waste at the Toisapu TPA in 2019 and 2020. Secondary data were obtained from the Central Statistics Agency of Ambon City, the National Waste Management Information System, and several previous studies**.**

3. Analisis data

The data analysis technique was carried out using the Paired Sample T Test using the IBM Statistics SPSS 25 application. The Paired Sample T Test or two-sample difference test is a statistical test that compares the average of two data but comes from the same sample group. This same sample underwent two different treatments to see a significant difference between the two data groups (Arifin, 2018).

D. Result and Discussion

1. Result

The waste intensity that goes to the TPA is obtained from the waste weighing. The following is the amount of waste that enters the Toisapu TPA per month in 2019-2020.

Table 1. The amount of waste that enters the Toisapu TPA per month in 2019-2020

Month	2019	2020
	Amount trash (ton)	Amount trash (ton)
January	5546.9	5015.4
February	4693.4	5172.6
March	5261.8	5290.3
April	5146.5	4470.4
May	5673.2	5165.9
Juny	4862.5	4703.4
July	5165.6	4914.0
August	5150.7	4645.5
September	5073.8	4783.0
October	4868.6	4794.2
November	5510.3	4846.0
December	6442.0	5867.9
Total	63,395	59,668.6

Source: Weighbridge Data UPTD IPST TPA Toisapu Ambon City

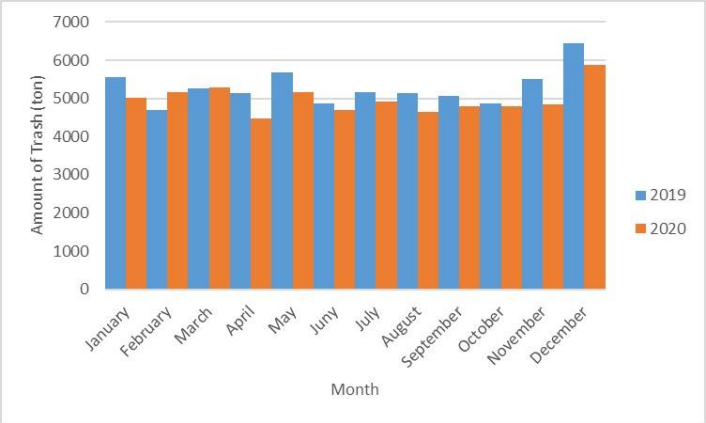

Figure 5. Comparison of the amount of waste before and during the Covid-19 pandemic from Ambon City. Source: Weighbridge Data UPTD IPST TPA Toisapu Ambon City

From the data above, the test was carried out using the Paired Sample T Test with the following results:

Table 2. Paired Samples Statistics

		Mean	N	Correlation	Sig.
Pair 1	Before pandemic in 2019	5282.9417	12	467.79499	135.04078
	After Pandemic in 2020	4972.3833	12	369.34779	106.62152

Output samples statistics, The mean column contains information onn the average amount of waste before Covid-19 in 2019 (5282.94 tons) and the Covid-19 period in 2020 (4972.38 tons).

Table 3. Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Before pandemic in 2019 & After Pandemic in 2020	12	.693	.013

The output of Paired sample correlations contains information on the correlation of the two variables (0.693) with a probability value (sig.) of 0.013 > 0.05. The correlation of 0.693 indicates a strong correlation between the amount of waste before and during COVID-19. However, the probability value is insignificant, with a probability value (sig.) of 0.013 > 0.05. This shows that the COVID-19 pandemic is correlated with a decrease in the amount of waste at the Toisapu TPA, Ambon city, but not significantly.

Tabel . 4 Paired Samples Test

		Paired Differences			
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Lower
Pair 1	Before pandemic in 2019 & After Pandemic in 2020	310.5583	340.43710	98.27573	94.25429

		95% Confidence Interfal of The Upper	t	df	Sig. (2-tailed)
Pair 1	Before pandemic in 2019 & After Pandemic in 2020	526.86175	3.160	11	.009

The hypothesis is made as follows
H0 = The average amount of waste is the same
H1 = Average amount of different waste

Decision-making with t count:

Look at the value of the t table with the provisions of /2 = 0.05/2 = 0.025 (two-sided test). The degrees of freedom (df-degree of freedom) are calculated using the formula = Total data-2 = 12-2=10 so that the t table value is 2.6338

Determining criteria as the basis for decision making
If the value of t count < value of t table, H0 is accepted, H1 is rejected
If the value of t count > the value of t table, H0 is rejected, H1 is accepted

Because the t-count value is 3.160 > 2.6338 (t table value), H0 is rejected, or H1 is accepted, which can be concluded The average amount of waste before and during the Covid-19 period is different, so it can be stated that Covid-19 affects the amount of waste that enters the Toisapu TPS.

Table.5 t-Tabel

df	Alpha (α)				
	t				
	0,005	**0,01**	**0,025**	**0,05**	**0,1**
1	127,3213	63,6567	25,4517	12,7062	6,3138
2	14,0890	9,9248	6,2053	4,3027	2,9200
3	7,4533	5,8409	4,1765	3,1824	2,3534
4	5,5976	4,6041	3,4954	2,7764	2,1318
5	4,7733	4,0321	3,1634	2,5706	2,0150
6	4,3168	3,7074	2,9687	2,4469	1,9432
7	4,0293	3,4995	2,8412	2,3646	1,8946
8	3,8325	3,3554	2,7515	2,3060	1,8595
9	3,6897	3,2498	2,6850	2,2622	1,8331
10	3,5814	3,1693	2,6338	2,2281	1,8125
11	3,4966	3,1058	2,5931	2,2010	1,7959
12	3,4284	3,0545	2,5600	2,1788	1,7823

Making decission can be done based on the probability value (t) provided that if probability > 0.05, H0 is accepted or H1 is rejected. However, if the probability is < 0.05 then H0 is rejected or H1 is accepted. H0 indicates that the average amount of waste entering the TPA before and during the pandemic is the same, while H1 indicates that the average amount of waste entering the TPA before and during the pandemic is different. For the two-tailed (2-tailed) test, each side is divided by 2 provided that if probability/2 > 0.025 , H0 is accepted or H1 is rejected and if probability/2 < 0.025 , H0 is rejected or H1 is accepted.

2. Discussion

The probability value or Sig 0.009, for two sides – sig. (2-tailed) so that the probability for decision-making is 0.009/2 = 0.0045. Because 0.0045 < 0.025, thus H0 is rejected, which means H1 is accepted. It can be concluded the average amount of waste before and during the Covid-19 period is different, so it can be stated that Covid-19 affects the amount of waste that enters the Toisapu TPS. The average amount of waste that enters the Toisapu TPS during the pandemic has decreased but not significantly. This result is from previous research conducted by Ruslida *et al*. (2021), which showed a decrease in the amount of waste entering the Payakumbuh City Regional TPA during the Covid-19 pandemic by 11.15%. The reduced amount of waste is due to the reduced amount sourced from commercial, institutional, and community service facilities.

Several factors have an impact on reducing the amount of waste in the Toisapu TPA in Ambon City during the pandemic namely the reduced population in Ambon City. Ambon is the capital of Maluku province which is the center of ports, tourism and education in Maluku province. The Large-Scale Social Restrictions (PSBB) in 2020 lead to reduced community activities in Ambon city. The number of students who live in the city of Ambon is decreasing, due to the learning system that has changed to online so that many students from universities in the city of Ambon choose to return to their hometown. It is known that in the city of Ambon there are 5 state universities and 9 private universities with more than 11,221 students from various regions in Maluku and outside Maluku (BPS Ambon City, 2020). The online learning system is the trigger for students to choose courses from their respective regions. (Prihandoko & Setiabudi, 2022) explained that the trend of decreasing the volume of waste generation in the Integrated Waste Disposal Site (TPST) during the pandemic was one of the reasons for the

decrease in the population in the city which was triggered by a decrease in the number of students who prefer to conduct online lectures from their respective regions. .

Changes in lifestyle during the pandemic have also changed the type of waste that enters the TPS. As shown in Figures 3 and 5, the composition of waste in Ambon City in 2020 is different from the previous year. Types of plastic waste during the pandemic increased by 1.3%. This is due to changes in people's lifestyles who choose an online or takeaway shopping system due to the implementation of social distancing. Shopping activities carried out through online media have an impact on the use of plastic as wrapping material. In DKI Jakarta, there was an increase in plastic waste during the pandemic because 49% of online shopping items were wrapped in plastic. This is in line with the research of Prasetya dan Jualiardi (2021), that during the pandemic, the composition of waste that experienced the largest increase was plastic waste.

In addition to plastic waste, in Ambon City, the type of food waste also increased by 1% from 2019. Food waste is organic waste, most of which comes from household activities. Prasetya dan Jualiardi (2021) showed an increase in household waste generation during the COVID-19 pandemic in the city of Surabaya which was dominated by organic waste that could be composted. According to Ruslinda et al. (2021), during the pandemic, there was a downward trend in the amount of waste entering the landfill, especially from commercial sources 29.48%, institutions 50%, and city community service facilities 37.23%. However, there was an increase in the amount of domestic waste by 21.22%. This is due to restrictions on community activities in public spaces so that people are more active at home, which has an impact on increasing the amount of domestic waste. However, the overall amount of waste in the Toisapu TPA has decreased during the pandemic.

E. Conclusion

From this research, it is concluded that:

1. The correlation of the two variables (0.693) with a probability value (sig.) 0.013 > 0.05. The correlation of 0.693 indicates a strong correlation between the amount of waste before and during COVID-19. However, the probability value is insignificant, with a probability value (sig.) of 0.013 > 0.05. This shows that COVID-19 affects the amount of waste that enters the Toisapu TPS but not significantly.
2. The calculated t value is 3.160 > 2.6338 (t table value) so that H0 is rejected or H1 is accepted, so it can be concluded that the average amount of waste before and during the Covid-19 period is different.

Acknowledgement

Thank you to Mrs Irene M. Sohilait as the head of the Regional Technical Implementation Unit of the Ambon City Integrated Waste Management Agency, who has collaborated in providing the data needed in this research.

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