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Konsumsi Minuman Alkohol Komersial dan Oplosan terhadap Pakan Harian, Perilaku, Berat Badan, dan Morfologi Hati Pada Tikus Putih (*Rattus norvegicus*)

*The Consumption of Commercial Red Wine 19,8% and Illicit Alcoholic/Oplosan Beverages on Daily Feed, Behavior, Body Weight, and Liver Morphology in White Rats (*Rattus norvegicus*)*

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Artikel Penelitian

Article History:

Received: 18 Jan, 2026

Revised: 08 Feb, 2026

Accepted: 23 Feb, 2026

Kata Kunci:

Alkohol Komersial;

Oplosan;

Perilaku Motorik;

Konsumsi Pakan;

Rattus norvegicus

Keywords:

Commercial Alcohol;

Illicit Alcohol;

Motor Behavior;

Feed Intake;

Liver Morphology

DOI: [10.56338/jks.v9i2.10423](https://doi.org/10.56338/jks.v9i2.10423)

ABSTRAK

Penelitian ini bertujuan mengetahui efek konsumsi anggur merah komersial (19,8%) dan minuman oplosan terhadap konsumsi pakan, berat badan, perilaku motorik, serta morfologi hati tikus putih (*Rattus norvegicus*). Sebanyak sembilan ekor tikus jantan dewasa dibagi acak menjadi tiga kelompok: kontrol (air), alkohol komersial, dan oplosan. Perlakuan diberikan secara oral selama 30 hari. Parameter yang diukur meliputi konsumsi pakan dan air harian, perubahan berat badan mingguan, perilaku kecemasan melalui uji Black and White Box, serta pemeriksaan morfologi hati secara mikroskopis pasca-nekropsi. Hasil menunjukkan bahwa kedua jenis alkohol menurunkan konsumsi pakan, berat badan, dan aktivitas motorik, serta meningkatkan kecenderungan perilaku cemas, dengan dampak paling menonjol pada kelompok oplosan. Pengamatan mikroskopis hati tidak mengindikasikan kerusakan struktural yang nyata, meskipun kemungkinan perubahan mikroskopis tetap ada dan memerlukan analisis histopatologi lanjutan. Kesimpulannya, konsumsi alkohol, khususnya oplosan, berpotensi menimbulkan gangguan fisiologis dan perilaku meskipun perubahan anatomis mikroskopis hati belum terlihat dalam periode perlakuan 30 hari.

ABSTRACT

*This study aimed to investigate the effects of commercial red wine (19.8% alcohol) and homemade illicit alcoholic beverages ("oplosan") on feed intake, body weight, motor behavior, and liver morphology in white rats (*Rattus norvegicus*). Nine adult male rats were randomly assigned to three groups: control (water), commercial alcohol, and oplosan. Treatments were administered orally for 30 days. Parameters measured included daily feed and water consumption, weekly body weight changes, anxiety-related behavior assessed*

using the Black and White Box test, and macroscopic examination of the liver post-necropsy. The results indicated that both types of alcohol reduced feed intake, body weight, and motor activity, while increasing anxiety-like behaviors, with the most pronounced effects observed in the oplosan group. Macroscopic liver observations did not reveal evident structural damage, although the possibility of microscopic alterations remains and warrants further histopathological analysis. In conclusion, alcohol consumption, particularly oplosan, has the potential to induce physiological and behavioral impairments despite the absence of visible macroscopic anatomical changes in the liver within the 30-day treatment period.

PENDAHULUAN

Konsumsi alkohol, baik yang berasal dari minuman beralkohol komersial maupun oplosan, menjadi isu kesehatan masyarakat yang penting di Indonesia. Tingginya konsumsi alkohol yang tidak bertanggung jawab, serta beredarnya minuman oplosan yang tidak terstandarisasi, meningkatkan risiko kesehatan dan kematian (Hanifah, 2023; Kanda & Riana, 2024).

Alkohol dihasilkan dari proses fermentasi karbohidrat dan ragi. Larutan ini mudah menguap dan dapat bercampur dalam air, eter, atau kloroform (Kartika, 2022). Alkohol merupakan zat psikoaktif yang bersifat aditif, berhubung alkohol bekerja menimbulkan perubahan pada perilaku, emosi, kognitif, persepsi, dan kesadaran seseorang. Zat ini menyebabkan ketergantungan atau kecanduan terhadap penggunaannya (Zuhri & Dona, 2021).

Berdasarkan Peraturan Menteri Kesehatan RI Nomor 86 tahun 1977, perihal minuman keras diterangkan bahwa minuman keras adalah semua jenis minuman beralkohol yang tidak digunakan untuk pengobatan, meliputi minuman keras golongan A dengan kadar etanol 1-5%, minuman keras golongan B dengan kadar etanol 5-20%, dan minuman keras golongan C dengan kadar etanol 20-55%.

Anggur merah merupakan salah satu alkohol komersial yang populer, dihasilkan dari fermentasi buah anggur, air, gula pasir, spirit anggur, dan pengawet natrium metabisulfit. Sebaliknya, minuman oplosan dibuat dari campuran alkohol dengan bahan lain seperti minuman energi, soda, spiritus, dan obat-obatan (Mulyadi, 2014). Tidak ada komposisi khusus dalam membuat oplosan. Oplosan dibuat dengan mempertimbangkan keinginan dosis memabukan yang ingin dicapai oleh si pembuat. (Kanda & Riana, 2024).

Alkohol merupakan zat psikoaktif, konsumsi alkohol secara berlebihan mengakibatkan hilangnya kesadaran (mabuk), kecanduan, dan bisa menyebabkan perubahan dalam sistem tubuh. Alkohol dapat menimbulkan berbagai gangguan fungsi organ manusia seperti pada hati, pancreas, dan memicu penyakit kanker (Hanifah, 2023).

Meskipun banyak penelitian sebelumnya meneliti efek alkohol komersial, khususnya anggur merah, atau minuman oplosan pada hewan percobaan, produk yang digunakan dalam penelitian ini berbeda dari yang biasanya beredar di pasaran, termasuk anggur merah dengan konsentrasi 19,8% dan jenis oplosan spesifik. Selain itu, studi yang membandingkan dampak alkohol komersial dan oplosan secara langsung terhadap beberapa parameter fisiologis dan perilaku pada tikus putih masih terbatas. Oleh karena itu, penelitian ini penting untuk mengisi kekosongan informasi mengenai pengaruh konsumsi alkohol terhadap konsumsi pakan, berat badan, perilaku motorik, dan morfologi hati, sekaligus memberikan dasar bagi edukasi masyarakat dan pengembangan kebijakan kesehatan.

Penelitian ini bertujuan menganalisis pengaruh pemberian minuman beralkohol komersial dan oplosan terhadap **(1)** konsumsi pakan harian, **(2)** berat badan **(3)** perilaku motorik dan **(4)** morfologi hati tikus putih (*Rattus norvegicus*).

Alcohol consumption, both from commercial alcoholic beverages and illicit alcohol/Oplosan, is a significant public health issue in Indonesia. The high rate of irresponsible alcohol consumption, along with the circulation of unstandardized mixed drinks, increases health risks and mortality (Hanifah, 2023; Kanda & Riana, 2024).

Alcohol is produced through the fermentation of carbohydrates and yeast. This solution is volatile and can mix with water, ether, or chloroform (Kartika, 2022). Alcohol is an addictive psychoactive substance because it works by causing changes in a person's behavior, emotions, cognition, perception, and consciousness. This substance leads to dependence or addiction in its users (Zuhri & Dona, 2021).

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 86 of 1977, alcoholic beverages are defined as all types of alcoholic drinks not used for medicinal purposes, including Group A alcoholic beverages with an ethanol content of 1-5%, Group B alcoholic beverages with an ethanol content of 5-20%, and Group C alcoholic beverages with an ethanol content of 20-55%.

Red wine is one of the most popular commercial alcohols, produced from the fermentation of grapes, water, sugar, grape spirits, and sodium metabisulfite as a preservative. In contrast, Oplosan are made from a mixture of alcohol with other ingredients like energy drinks, soda, methylated spirits, and drugs (Mulyadi, 2014). There is no specific composition for making these mixed drinks; they are made with the goal of achieving the intoxicating dose desired by the maker (Kanda & Riana, 2024).

Alcohol is a psychoactive substance, and excessive consumption can lead to a loss of consciousness (intoxication), addiction, and changes in the body's systems. Alcohol can cause various human organ dysfunctions, such as in the liver and pancreas, and trigger cancer (Hanifah, 2023).

Although many previous studies have investigated the effects of commercial alcohol, particularly red wine, or illicit alcohol on experimental animals, the products used in this study differ from those commonly available on the market, including red wine with a concentration of 19.8% and a specific type of illicit alcohol. Moreover, studies directly comparing the effects of commercial alcohol and illicit alcohol on multiple physiological and behavioral parameters in white rats are still limited. Therefore, this study is important to fill the gap in knowledge regarding the impact of alcohol consumption on daily food intake, body weight, motor behavior, and liver morphology, while also providing a basis for public education and health policy development.

This study aims to analyze the effects of commercial and illicit alcoholic beverages on (1) daily feed consumption, (2) body weight, (3) motor behavior, and (4) liver morphology in white rats (*Rattus norvegicus*).

METODE

2.1. Alat dan Bahan

Peralatan: kandang tikus, tempat pakan, botol minum, seperangkat alat bedah, cawan petri, kamera, mikroskop, timbangan, dan gelas ukur.

Bahan: sembilan ekor tikus jantan dewasa (200–300 g), anggur merah merek Cap Orang Tua (19,8%), larutan NaCl 0,9%, sekam, pakan pelet, air mineral, dan aquadest.

2.2. Tahap persiapan

Tikus diaklimatisasi selama 7 hari sebelum perlakuan. Pembelian alkohol komersial dan pembuatan oplosan di laboratorium.

2.3 Tahap pelaksanaan

Penelitian dibagi menjadi tiga kelompok perlakuan (n=3/kelompok):

1. P0 (Kontrol): Air
2. P1 (Alkohol Komersial): Anggur merah komersial 19,8%
3. P2 (Oplosan): Alkohol dan bahan tambahan

Perlakuan diberikan selama 30 hari secara oral. Pemilihan durasi 30 hari mengacu pada Saraswati et al. (2009) yang menunjukkan bahwa periode ini cukup untuk memunculkan efek fisiologis awal pada hewan coba.

2.4. Tahap Pengamatan

Data yang diambil pada penelitian ini, meliputi konsumsi pakan dan minum yang dilakukan pencatatan setiap hari; 2) Perubahan Berat badan tikus yang diukur mingguan; 3) perilaku motorik

dan kecemasan yang diuji dengan metode Black and White Box (Ruan & Yao, 2021); 4) Morfologi hati yang diamati secara makroskopis setelah pembedahan di hari ke-31.

2.1. Tools and Materials

Equipment: rat cages, feed troughs, drinking bottles, a set of surgical instruments, petri dishes, a camera, scales, and a measuring cylinder.

Materials: nine adult male rats (200–300 g), red wine (OT) (19.8%), illicit alcohol/oplosan (OP), 0.9% NaCl solution, husks, pellet feed, mineral water (C), and distilled water.

2.2. Preparation Phase

The rats were acclimatized for 7 days before treatment. Commercial alcohol was purchased and the Oplosan was prepared in the laboratory.

2.3. Observation Phase

The study was divided into three treatment groups (n=3/group):

1. P0 (Control): Water
2. P1 (Commercial Alcohol): Commercial Red Wine 19.8%
3. P2 (Oplosan): Alcohol and additional ingredients

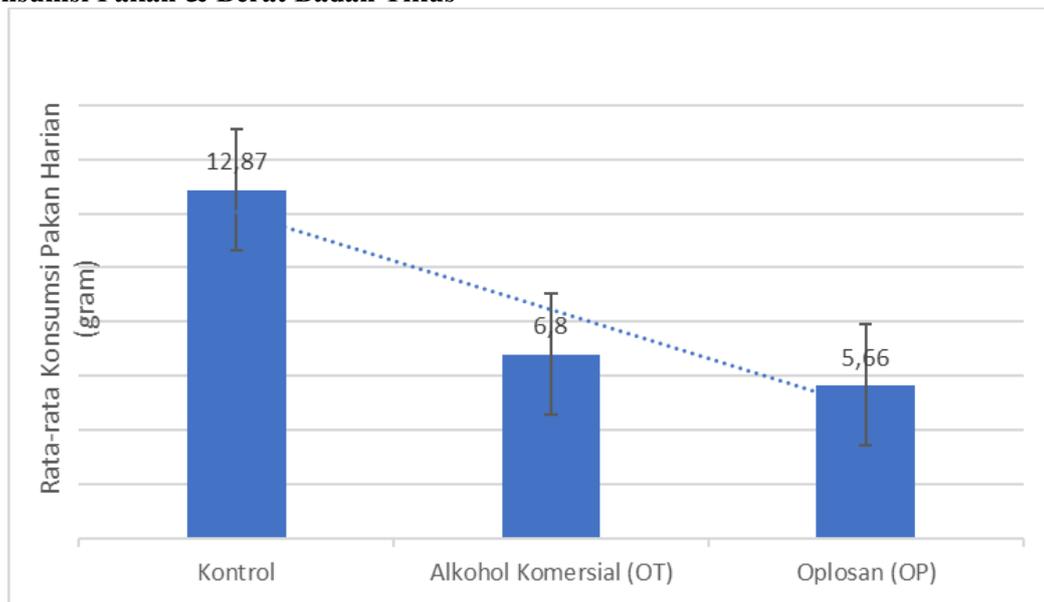
The treatment was administered orally for 30 days. The 30-day duration was chosen based on Saraswati et al. (2009), which showed that this period is sufficient to induce early physiological effects in the test animals.

2.4. Execution Phase

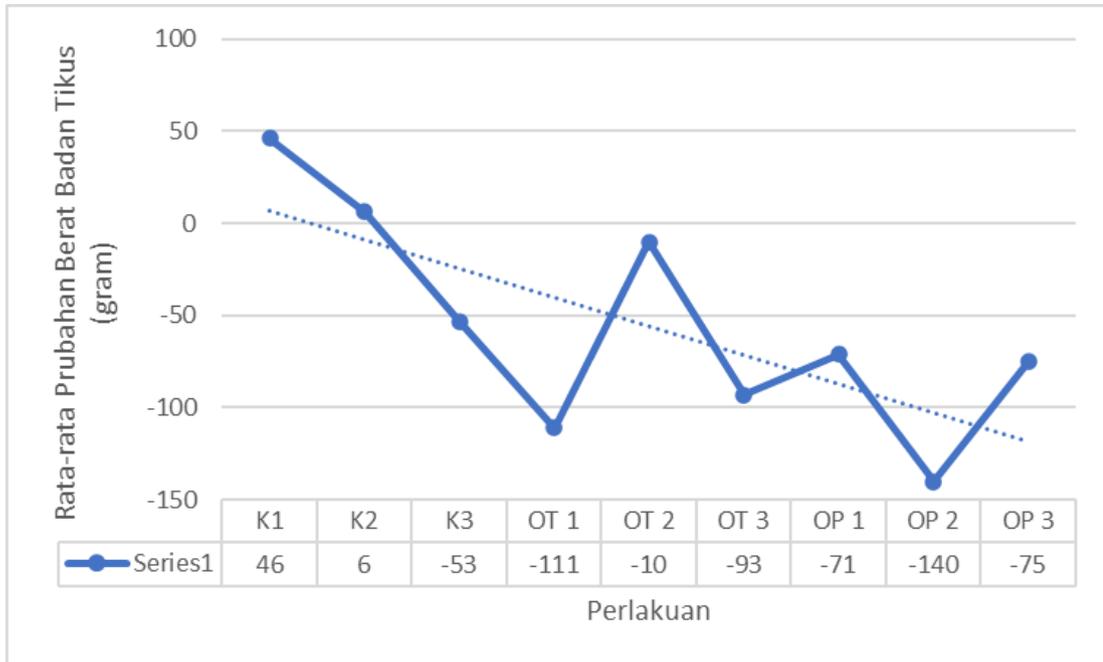
The data taken in this study includes: 1) daily food and water consumption, which was recorded every day; 2) changes in rat body weight, measured weekly; 3) motor behavior and anxiety, tested using the Black and White Box method (Ruan & Yao, 2021); 4) liver morphology, which was observed macroscopically after dissection on day 31.

HASIL

3.1. Konsumsi Pakan & Berat Badan Tikus

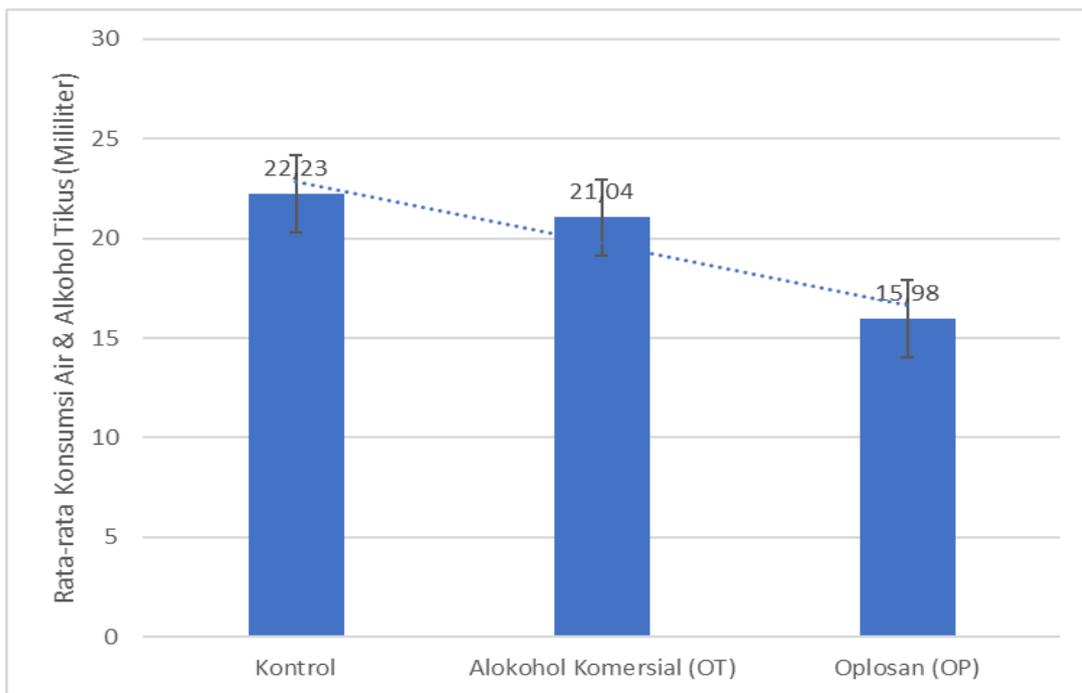


Grafik 1. Rata-rata Konsumsi Pakan Harian Tikus



Keterangan Grafik : K (Kontrol); OT (Anggur Merah 19,8%); OP (Oplosan)
 Grafik 2. Rata-rata Perubahan Berat Badan Tikus Pasca Konsumsi Alkohol 30 hari

3.2. Rata-Rata Konsumsi Air & Alkohol Harian Tikus



Grafik 3. Rata-rata Konsumsi Air & Alkohol Harian Tikus

3.3. Pengaruh Minuman Beralkohol Terhadap Perilaku Motorik (Kecemasan)

Tabel 1. Pengaruh Alkohol Terhadap Kondisi Anxiety Tikus

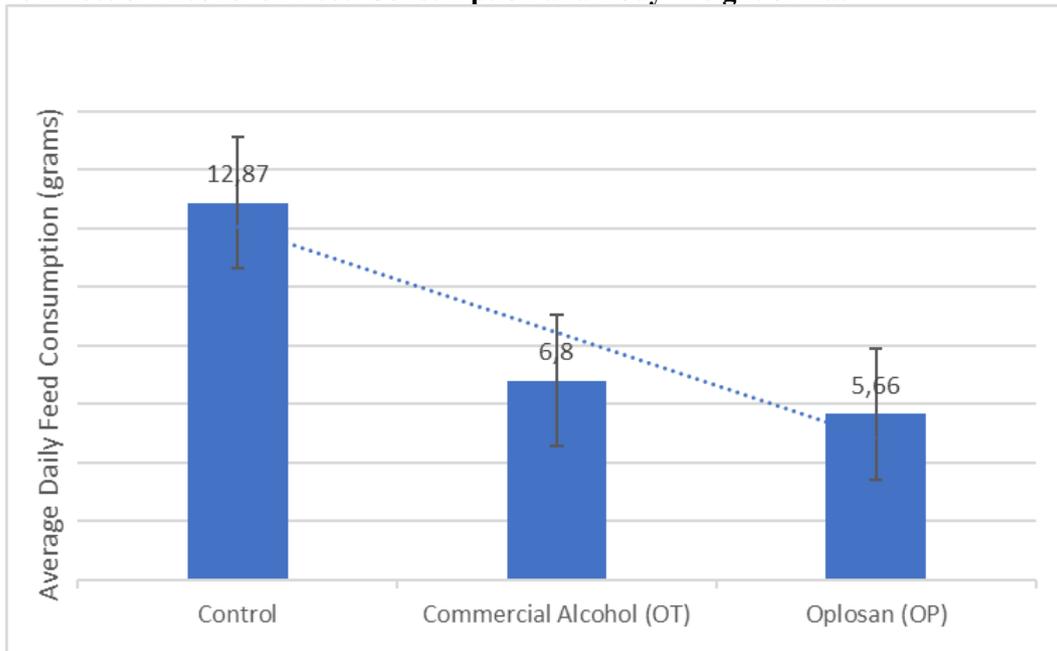
Sampel	Ulangan	Kondisi Motorik Tikus
Kontrol (Air)	1	Tidak agresif. Saat melakukan tes <i>Black and White Box</i> ia aktif pada awal lima menit, dan mulai tetap di sisi gelap. Sering di area pojok.
	2	Tidak agresif. Saat melakukan tes <i>Black and White Box</i> aktif pada enam menit pertama, dan mulai menurun di menit ke tujuh. Setelahnya menetap di salah satu sisi lebih lama walaupun masih sering berpindah di menit ke delapan dan menetap di sisi terang.
	3	Tidak agresif. Saat melakukan tes <i>Black and White Box</i> sering berpindah tempat sampai menit ke tujuh. Sering mengikuti tikus yang lain. Pada menit ke delapan tetap di sisi terang.
Alkohol Komersial (AK) - Alkohol 19,8%	1	Terlihat lemas dan tidak aktif. Saat dilakukannya tes <i>anxiety</i> tikus tidak terlalu bereksplorasi dan menetap di sisi gelap.
	2	Agresif dan sangat aktif selama proses tes. Tikus sering mencoba untuk menggigit saat di dalam kandang. Saat tes <i>Black and White Box</i> , tikus terlihat aktif bereksplorasi selama enam menit, setelah itu tikus menetap di sisi terang.
	3	Sangat aktif namun tidak agresif. Saat dilakukannya tes <i>Black and White Box</i> , tikus tidak terlalu aktif dan lebih sering di sisi gelap. Di lima menit awal ia bereksplorasi namun tidak terlalu aktif. Sejak menit ke enam tikus menetap di sisi gelap.
Oplosan	1	Tidak terlalu aktif. Saat pengujian <i>Black and White Box</i> tikus tidak terlalu bereksplorasi dan lebih sering di sisi gelap. Namun, sejak menit ke tujuh ia menetap di sisi terang.
	2	Agresif dan sangat aktif selama tes. Saat pengujian sangat aktif dan sering berpindah-pindah sisi selama delapan menit dan akhirnya menetap di sisi terang.
	3	Agresif dan sangat aktif selama tes. Di awal lima menit tikus sangat aktif, dan setelah itu lebih sering di sisi terang.

3.4. Pengaruh Alkohol terhadap Morfologi Hati Tikus

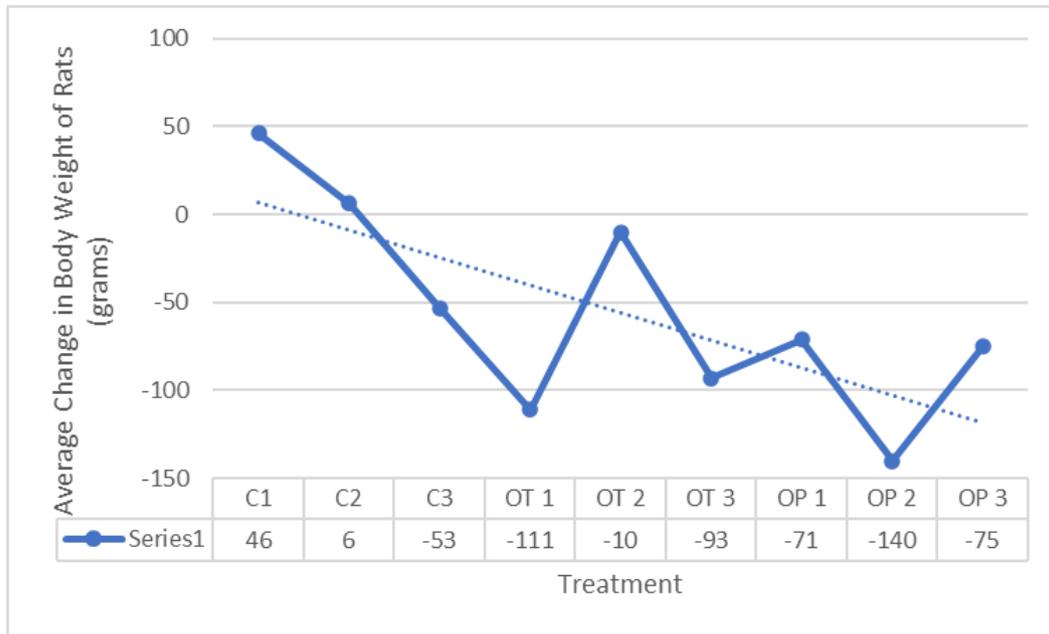
Tabel 2. Pengaruh Alkohol Terhadap Kondisi Morfologi Hati Tikus

Sampel	Dokumentasi	Kondisi Morfologi Hati
Kontrol (Air)		Hati berwarna coklat ke merah-merahan, tidak ada benjolan dan memiliki permukaan yang halus.
Minuman Alkohol Komersial (AK) 19,8%		Hati memiliki warna yang coklat ke merah-merahan namun agak pucat, tidak ada benjolan dan permukaan hati halus.
Oplosan		Hati berwarna coklat ke merah-merah, tidak ada benjolan, dan permukaan hati halus.

3.1. The Effect of Alcohol on Feed Consumption and Body Weight of Rat

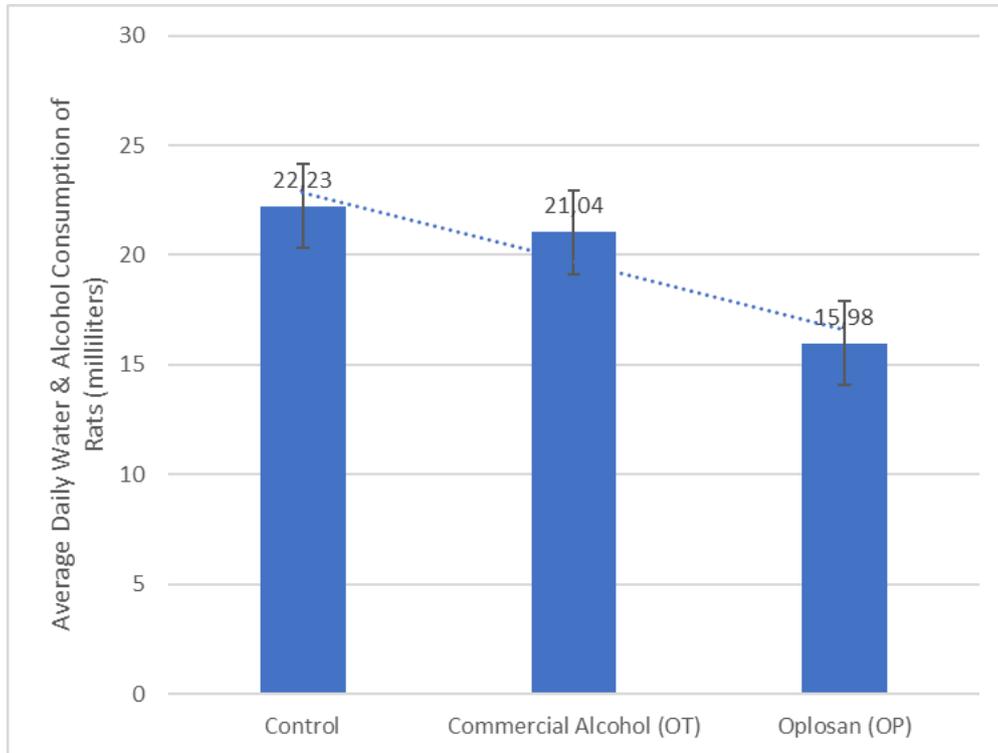


Graph 1. The Effect of Alcohol on Daily Feed Consumption of Rat



Explanation Figure: C (Control); OT (Commercial Red Wine 19.8%); OP (Oplosan)

Graph 2. The Effect of Alcohol on Body Weight of Rat



Graph 3. The Effect of Alcohol on Average Daily Water and Alcohol Consumption of Rats

3.3. Effect of Alcoholic Drinks to Rats’s Motoric Behavior (Anxiety)

Figure 1. Effect of Alcohol on Rats Behavior

Sample	Repetition	Rats Motoric Condition
Control (Water)	1	Not aggressive. During the Black and White Box test, it was active for the first five minutes, then began to remain on the dark side. It often stays in the corner areas.
	2	Not aggressive. During the Black and White Box test, the animal was active for the first six minutes, with activity beginning to decrease in the seventh minute. Afterward, it spent longer periods on one side, although it still moved frequently in the eighth minute before ultimately settling on the bright side.
	3	Not aggressive. During the Black and White Box test, it moved around frequently until the seventh minute. It often followed the other mice. In the eighth minute, it remained on the bright side.

Commercial Alcohol (OT) - Alcohol 19.8%	1	The rats appeared nonenergetic and inactive. During the anxiety test, it didn't explore much and remained on the dark side.
	2	The rats was aggressive and very active throughout the test. It often tried to bite while in its cage. During the Black and White Box test, it actively explored for six minutes before settling on the bright side.
	3	Very active but not aggressive. During the Black and White Box test, the rats was not very active and spent more time on the dark side. For the first five minutes, it explored, but not very actively. From the sixth minute, the rats settled on the dark side.
Oplosan	1	Not very active. During the Black and White Box test, the rats didn't explore much and spent more time on the dark side. However, from the seventh minute, it settled on the bright side.
	2	Aggressive and very active throughout the test. During the test, it was very active and frequently moved between sides for eight minutes, finally settling on the bright side.
	3	Aggressive and very active throughout the test. For the first five minutes, the rats were very active, and after that, it spent more time on the bright side.

3.4. Effect of Alcohol on Liver Morphology

Figure 2. The Effect of Alcohol on Liver Morphology

Sample	Documentation	Morphology Condition of Liver
Control (Water)		The liver is brownish-red, has no nodules, and has a smooth surface.
Commercial Alcohol (OT) 19.8%		The liver is a slightly pale brownish-red, has no nodules, and has a smooth surface.

Oplosan		The liver is brownish-red, has no nodules, and has a smooth surface.
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DISKUSI

4.1. Konsumsi Pakan & Berat Badan Tikus

Grafik 1 & 2 menunjukkan adanya penurunan konsumsi pakan harian pada kelompok tikus yang diberi perlakuan alkohol dibandingkan kelompok kontrol. Hal ini sejalan dengan penelitian Ahmad & Mulyani (2017) yang melaporkan bahwa alkohol dapat menekan pusat pengaturan makan di hipotalamus, menurunkan leptin dan meningkatkan ghrelin sehingga mengubah nafsu makan.

Penurunan berat badan terlihat lebih signifikan pada kelompok oplosan (Grafik 1). Hal tersebut sesuai dengan penelitian Najiyah & Hariani (2021) yang melaporkan bahwa efek alkohol terhadap kenaikan berat badan tikus tergolong tidak signifikan, alkohol dapat meningkatkan katabolisme energi sehingga berat badan cenderung turun.

Menurut Saraswati dkk., (2009), alkohol dengan konsentrasi 4,8% dan diberikan kepada mencit sebanyak 0,5 ml secara per oral, sehari sekali selama tiga puluh hari menunjukkan bahwa terdapat pengaruh tapi tidak signifikan alkohol terhadap konsumsi pakan pada mencit. Penggunaan alkohol yang semakin meningkat dapat menyebabkan tertekannya sistem saraf pusat sehingga kerja hipotalamus sebagai regulator pakan dan minum terganggu.

4.2. Rata-Rata Konsumsi Air & Alkohol Harian Tikus

Berdasarkan grafik 3, terlihat perbedaan konsumsi antara air dengan alkohol baik anggur merah maupun oplosan. Rata-rata konsumsi air setiap harinya sebesar 22, 23 ml. Sedangkan rata-rata konsumsi harian anggur merah sebesar 21,04 ml. Tingkat konsumsi harian alkohol oplosan paling rendah yaitu sekitar 15,98 ml. Berdasarkan NCKU(National Cheng Kung University), kebutuhan atau konsumsi air normal pada tikus adalah sekitar 80–125 mL per kilogram berat badan 10-12 mL/100g per hari (<https://animal.ncku.edu.tw/>). Penurunan konsumsi air menunjukkan adanya gangguan homeostasis cairan (Tatsuo, 2020).

4.3. Pengaruh Minuman Beralkohol Terhadap Perilaku Motorik (Kecemasan)

Berdasarkan tabel 1, Kelompok alkohol menunjukkan perilaku yang kurang aktif, cenderung menetap di sisi gelap *Black and White Box*, indikasi kecemasan meningkat. Menurut Becker et al. (2008) dan Najafipour et al. (2019), paparan alkohol berulang meningkatkan kecemasan melalui penurunan ekspresi GABA. Etanol juga mempengaruhi sel Purkinje di otak kecil (Todd et al., 2022), yang mengatur koordinasi motorik. Ruan & Yao, (2021) menyatakan tikus akan menunjukkan perilaku eksploratif saat 5-10 menit pertama, yang akan menurun seiring waktu. Menurut Görisch & Schwarting, (2006) tikus yang memiliki lebih banyak rearing dan *locomotor activity* (pergerakan fisik organisme) adalah indikator normal dalam tikus yang sehat.

Berdasarkan penelitian Becker et al., (2008) menyatakan bahwa tikus yang diberi alkohol berulang menunjukkan peningkatan anxiety dengan pengaruh lebih lama dan lebih jelas setelah siklus paparan alkohol yang berulang. Menurut Najafipour et al., (2019) mengungkapkan bahwa paparan alkohol jangka panjang memicu tikus mengalami kecemasan dan penurunan ekspresi

GABA (Gamma-aminobutyric acid). Sandeep et al., (2010) menyatakan alkohol dapat menyebabkan berbagai efek seperti mengganggu koordinasi gerak, menurunkan kemampuan berpikir, menyebabkan kantuk, kehilangan kesadaran, dan terkadang meningkatkan agresivitas. Menurut penelitian Russel et al., (2019), Etanol mempengaruhi kerja protein FMRP (protein yang dihasilkan gen *Fmr1*) dalam mengatur sinyal otak, hal ini menyebabkan tubuh untuk sulit bergerak dengan baik (ataksia). Dylan et al., (2022) menyatakan etanol dengan CREB (Cre-negatif) membunuh 20% sel Purkinje (salah satu jenis sel saraf utama di otak kecil, mengatur koordinasi motorik) dan motorik tikus terganggu.

4.4. Pengaruh Alkohol terhadap Morfologi Hati Tikus

Secara makroskopis, kondisi morfologi hati pada semua kelompok perlakuan berwarna merah kecoklatan dengan permukaan halus, menunjukkan belum adanya kerusakan yang terlihat kasat mata. Namun, studi Keshavarzian et al. (2009) menunjukkan kerusakan hati akibat alkohol dapat mulai tampak secara mikroskopis setelah ≥ 8 minggu perlakuan. Alkohol merusak hati melalui mekanisme stres oksidatif, peradangan, dan gangguan autofagi (Salete-Granado et al., 2023; Ambade & Mandrekar, 2012).

Menurut Lailatul *et al.*, (2015), hati yang normal menunjukkan warna merah kecoklatan. Hal ini dikarenakan banyaknya jumlah darah yang mengalir melalui pembuluh darah. Hal ini juga disampaikan dalam penelitian Fortes (2017), bahwa hati yang normal memiliki warna merah kecoklatan karena aliran darah mengalir masuk ke organ hati.

Menurut Sijid, et al., (2020), terdapat pengaruh pemberian tuak dengan dosis yang berbeda-beda memperlihatkan bahwa tidak adanya perubahan sel-sel hati. Jaringan hati yang normal bisa diidentifikasi dengan adanya sel parenkim dan sel lainnya yang terlihat normal pada pemeriksaan mikroskop.

Menurut Keshavarzian, et al., (2009), kondisi hati tikus setelah treatment alkohol selama 10 minggu menunjukkan lemak di hati meningkat setelah dua minggu perlakuan, tapi bukti menunjukkan bahwa rusaknya jaringan di hati dapat teridentifikasi setelah delapan minggu perlakuan. Berdasarkan Kodariah, et al., (2022), konsumsi alkohol dapat menyebabkan kerusakan sel-sel hati (hepatocyte cell).

Berdasarkan Salete-Granado, et al., (2023), Konsumsi alkohol secara kronis dalam jangka waktu yang lama menurunkan aktivitas autofagi (saat makrofag memakan sel-sel) dalam hati. Menurut Ambada & Mandrekar, (2023) kerusakan hati akibat alkohol menyebabkan stres oksidatif (tekanan dalam sel yang disebabkan oleh molekul berbahaya bernama ROS) memiliki peran besar dalam menyebabkan peradangan dan mengaktifkan makrofag yang mengeluarkan sitokin proinflamasi (zat penyebab radang).

4.1. The Effect of Alcohol on Feed Consumption and Body Weight of Rat

Graphs 1 and 2 show a decrease in daily feed consumption in the alcohol-treated groups compared to the control group. This is consistent with research by Ahmad & Mulyani (2017), who reported that alcohol can suppress the feeding center in the hypothalamus, decrease leptin, and increase ghrelin, thereby changing appetite.

The decrease in body weight appears more significant in the Oplosan group (Graph 1). This aligns with the research of Najiyah & Hariani (2021), who reported that the effect of alcohol on rat weight gain is not significant and that alcohol can increase energy catabolism, causing body weight to tend to decrease.

According to Saraswati et al. (2009), alcohol with a concentration of 4.8%, given orally to mice at 0.5 ml once a day for thirty days, showed an effect on feed consumption, but it was not significant. Increasing alcohol use can suppress the central nervous system, which in turn disrupts the function of the hypothalamus as a regulator of food and drink.

4.2. Effect of Alcohol on Average Daily Water and Alcohol Consumption of Rats

Based on graph 3, a difference in consumption is visible between water and alcohol, specifically red wine and *oplosan* (a type of mixed liquor). The average daily water consumption is 22.23 ml, while the average daily red wine consumption is 21.04 ml. The daily consumption of *oplosan* is the lowest, at around 15.98 ml. According to NCKU (National Cheng Kung University), the normal water consumption for mice is about 80–125 ml per kilogram of body weight, or 10–12 ml/100g per day (<https://animal.ncku.edu.tw/>). A decrease in water consumption suggests a disturbance in fluid homeostasis (Tatsuo, 2020).

4.3. Effect of Alcoholic Drinks to Rats's Motoric Behavior (Anxiety)

Based on table 1, the alcohol group showed less active behavior, tending to stay on the dark side of the Black and White Box, indicating increased anxiety. According to Becker et al. (2008) and Najafipour et al. (2019), repeated alcohol exposure increases anxiety by decreasing GABA expression. Ethanol also affects Purkinje cells in the cerebellum (Todd et al., 2022), which regulate motor coordination. Ruan & Yao (2021) stated that mice will show exploratory behavior during the first 5-10 minutes, which will decrease over time. According to Görisch & Schwarting (2006), mice with more rearing and locomotor activity are normal indicators in healthy mice.

A study by Becker et al. (2008) stated that mice given repeated alcohol exposure showed increased anxiety with a longer and clearer effect after repeated cycles of alcohol exposure. According to Najafipour et al. (2019), long-term alcohol exposure triggers anxiety in mice and decreases the expression of GABA (Gamma-aminobutyric acid). Sandeep et al. (2010) stated that alcohol can cause various effects such as disrupting motor coordination, decreasing cognitive ability, causing drowsiness, loss of consciousness, and sometimes increasing aggressiveness.

According to a study by Russel et al. (2019), ethanol affects the function of FMRP protein (a protein produced by the *Fmr1* gene) in regulating brain signals, which causes the body to have difficulty moving properly (ataxia). Dylan et al. (2022) stated that ethanol with CREB (Cre-negative) kills 20% of Purkinje cells (one of the main types of nerve cells in the cerebellum that regulate motor coordination) and disrupts rats motor function.

4.4. Effect of Alcohol on Liver Morphology

Macroscopically, the liver morphology in all treatment groups was brownish-red with a smooth surface, indicating no damage was visible to the naked eye. However, a study by Keshavarzian et al. (2009) showed that alcohol-induced liver damage can begin to appear microscopically after ≥ 8 weeks of treatment. Alcohol damages the liver through mechanisms of oxidative stress, inflammation, and autophagy disruption (Salette-Granado et al., 2023; Ambade & Mandrekar, 2012). According to Lailatul et al. (2015), a normal liver shows a brownish-red color. This is due to the large amount of blood flowing through its vessels. This is also stated in a study by Fortes (2017), that a normal liver has a brownish-red color because of the blood flow entering the organ. According to Sijid et al. (2020), the administration of palm wine at different doses showed no changes in liver cells. Normal liver tissue can be identified by the presence of parenchymal cells and other cells that appear normal upon microscopic examination.

According to Keshavarzian et al. (2009), the condition of a rat's liver after 10 weeks of alcohol treatment shows that fat in the liver increases after two weeks of treatment, but evidence of tissue damage becomes identifiable after eight weeks of treatment. Based on Kodariah et al. (2022), alcohol consumption can cause damage to liver cells (hepatocytes).

According to Salate-Granado et al. (2023), chronic alcohol consumption over a long period reduces the activity of autophagy (when macrophages consume cells) in the liver. According to Ambada & Mandrekar (2023), alcohol-induced liver damage causes oxidative stress (pressure

within cells caused by harmful molecules called ROS), which plays a major role in causing inflammation and activating macrophages that release pro-inflammatory cytokines (substances that cause inflammation).

KESIMPULAN

Kesimpulan dari penelitian ini adalah pemberian alkohol komersial dan oplosan selama 30 hari pada tikus putih menurunkan konsumsi pakan dan berat badan, mengurangi aktivitas motorik, serta meningkatkan indikasi kecemasan. Secara makroskopis, morfologi hati belum menunjukkan perubahan mencolok, namun potensi kerusakan mikroskopis perlu diinvestigasi lebih lanjut melalui pemeriksaan histopatologi. Efek negatif paling jelas terlihat pada kelompok oplosan.

The conclusion of this study is that the administration of commercial and oplosan (mixed liquor) alcohol for 30 days in white mice decreased feed consumption and body weight, reduced motor activity, and increased signs of anxiety. Macroscopically, the liver morphology did not show any noticeable changes, but the potential for microscopic damage needs to be further investigated through histopathological examination. The most obvious negative effects were seen in the oplosan group.

REKOMENDASI

Penelitian selanjutnya disarankan menggunakan sampel yang lebih besar dan menggunakan tikus Jantan serta betina untuk memperoleh hasil yang lebih representatif. Pengamatan perilaku sebaiknya dilakukan secara kuantitatif dengan parameter yang terukur. Selain itu, pemeriksaan hati perlu dilengkapi dengan analisis histopatologi, serta durasi perlakuan dapat diperpanjang untuk melihat efek alcohol secara signifikan.

Future studies are recommended to use larger sample sizes and include both male and female rats to obtain more representative results. Behavioral observations should be conducted quantitatively using measurable parameters. In addition, liver examination should be complemented with histopathological analysis, and the treatment duration can be extended to observe more significant effects of alcohol.

KETERBATASAN

Penelitian ini memiliki beberapa keterbatasan yaitu jumlah sampel yang relatif kecil, tikus yang digunakan adalah tikus Jantan saja, pengamatan perilaku yang bersifat kualitatif, serta observasi hati yang dilakukan secara makroskopis. Selain itu, durasi perlakuan mungkin bisa ditambah untuk menimbulkan perubahan yang signifikan.

This study had several limitations, including a relatively small sample size, the use of only male rats, qualitative behavioral observations, and liver assessment conducted only at the macroscopic level. In addition, the treatment duration may need to be extended to produce more significant changes.

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