JPPIPA 9(12) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Comparison of Serum Glutamic Pyruvic Transaminase and Serum Glutamic Oxaloacetic Transaminase Enzyme Levels between Light and Heavy Drinkers in Renon Village, Denpasar City

Ni Putu Rahayu Artini[1]*, I Wayan Tanjung Aryasa[1]

[1] Program Studi Teknologi Laboratorium Medik,, Fakultas Ilmu-Ilmu Kesehatan, Universitas Bali Internasional, Denpasar, Indonesia.

Received: October 12, 2023
Revised: November 5, 2023
Accepted: December 20, 2023
Published: December 31, 2023

Corresponding Author:
Ni Putu Rahayu Artini
artinirahayu967@gmail.com

DOI: 10.29303/jppipa.v9i12.6612

Abstract: Arak is a non-electrolyte liquid that easily circulates in the blood circulation and is absorbed in the digestive tract. One disease that can be caused by alcohol consumption is liver function disorders, such as alcoholic hepatitis. So it can increase the serum enzymes glutamate pyruvate transaminase (SGPT) and serum glutamic oxaloacetic transaminase (SGOT). This research was conducted on light and heavy drinkers in Renon Village, Denpasar City. This research uses a longitudinal quantitative design. The results obtained were that the average SGPT level of light drinkers was 46.21 ± 0.155 IU/L, while the respondents who were heavy drinkers had SGPT levels with an average of 64.02 ± 0.430 IU/L. for SGOT from light drinkers is 50.20 ± 0.101 IU/L. Respondents who drank heavily had SGPT levels with an average of 74.40 ± 0.048 IU/L. All wine drinkers, both light drinkers and heavy drinkers, had SGPT-SGOT levels that exceeded the reference value.

Keywords: Arak; Heavy drinkers; Light drinkers; SGOT; SGPT

Introduction

According to PERPRES (2013), alcoholic drinks are defined as drinks containing ethyl alcohol or ethanol (C_2H_5OH) which are processed from agricultural materials containing carbohydrates by fermentation. One of the results of this fermentation is wine. There are several types of arak that are usually sold by arak producers, with the characteristics of producing foam when shaken in the bottle and being easily licked by fire with a bluish color, and is often used for medicinal purposes, and is often even consumed by fans of Balinese arak with high alcohol content, up to 30%, while arak has a lower alcohol content, only reaching 20%. This type of arak is often consumed by Balinese arak fans, and as a spirit ingredient for cocktail drinks. Meanwhile, the lowest alcohol content, only 5-10% alcohol, is used as equipment or as a means for religious ceremonies (Astuti et al., 2018).

The arak producing areas in Bali are Karangasem, Buleleng and Klungkung. Besan Village, Dawan District, Klungkung is one of the wine producing villages in Klungkung Regency. In this village there are around 25 families capable of producing around 3-5 liters of wine every day. The resulting arak is made from coconut sap and fermented, then distilled traditionally. The wine is packaged using used drinking water bottles and sold freely in stalls, so that people can easily get this arak.

Among those who drink alcoholic drinks, this wine is mixed or mixes alcoholic drinks with various chemicals so that it has a higher risk compared to ordinary alcoholic drinks (Logan et al., 1999). From 2011 to 2016, the National Anti-Alcohol Movement recorded that the number of victims who died due to mixed liquor reached 18,000 people. If consumed excessively,

How to Cite:
Artini, N. P. R., & Aryasa, I. W. T. (2023). Comparison of Serum Glutamic Pyruvic Transaminase and Serum Glutamic Oxaloacetic Transaminase Enzyme Levels between Light and Heavy Drinkers in Renon Village, Denpasar City. *Jurnal Penelitian Pendidikan IPA*, *9*(12), 11871–11876. https://doi.org/10.29303/jppipa.v9i12.6612

alcoholic drinks can cause side effects in the form of organic mental disorders (GMO), namely disturbances in the function of thinking, feeling and criminal behavior (Julia, 2016). Although the effect on individuals varies, there is a relationship between blood alcohol concentration Blood Alcohol Concentration (BAC) and its effects (Julia, 2016; Rini, 2012).

Arak is a non-electrolyte liquid that can dissolve in fat so that it easily circulates in the blood circulation and is absorbed in the digestive tract (Amirudin, 2009). Ethanol consumed will be distributed to the intestines as much as 80 and 20% to the stomach and then undergo metabolism in the liver (Conreng et al., 2014; Gadallah et al., 2017; Farha & Eman, 2018; Indrayani et al., 2019). The concentration of ethanol in the blood determines the speed of metabolic processes in the liver by producing acetaldehyde, free radicals and increasing NADH/ADH (Dorland, 2008; Riyanto, 2014; Suaniti et al., 2012).

One of the diseases that can be caused by alcohol consumption is liver function disorders, such as fatty liver, alcoholic hepatitis and cirrhosis. Types of liver function tests that can be checked to assess liver damage are serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT), lactate dehydrogenase (LDH), alkaline phosphatase (ALP) and Gamma-GT enzymes. Gandasoebrata (2011) states that the negative impacts of alcohol abuse include increases in total bilirubin, direct bilirubin, indirect bilirubin, Gamma-GT, serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxaloacetate transaminase (SGOT).

According to Aritonang (2012), alcohol drinkers are divided into three groups, namely light drinkers who consume 0.28-5.9 mL of alcohol or less per day, moderate drinkers who consume 6.2-27.7 mL of alcohol per day and heavy drinkers who consume more than 28 mL of alcohol per day. Converted to the alcohol concentration in the arak so that the level of arak consumption can be divided into three, namely; Light drinkers consume 30 mL of wine or less per day, moderate drinkers consume 35-100 mL of wine per day and heavy drinkers consume more than 100 mL of wine per day (Rini, 2012). Based on the description above, the aim of this research is to determine the difference in SGPT levels between light drinkers and heavy drinkers.

Method

This study used a longitudinal quantitative design, namely comparing two groups using repeated measurement analysis techniques regarding the differences in blood SGPT levels between light and heavy wine drinkers in Renon Village, Denpasar City to see long-term differences. The equipment used in this research consisted of a phlebotomy tool. The tools for analysis consist of a photometer, centrifuge, micropipette and tip. The supporting tool is a questionnaire sheet which is used to obtain information regarding identity and informed consent which is an approval sheet for taking blood samples.

The research material consisted of blood samples from 30 Balinese wine drinkers, namely 15 light drinkers and 15 heavy drinkers in Renon Village, Denpasar City. The blood sample taken was 3 cc of venous blood, then separated to obtain serum. The chemicals used are SGPT reagents. The wine used in this study was taken from the wine seller where the probands had their blood taken. The samples were tested for ethanol content using a GC-MS tool with an FID detector (Frayekti, 2013). A standard ethanol solution was first run to validate the tool. The standard ethanol solution used was a standard ethanol solution with a concentration of 0, 2, 5, 25, 50, 125, 250, 500, and 1000 ppm. The sample injected was 1 µL. Arak levels were obtained from the linear regression equation of standard ethanol solutions (Bidlabfor Polda Bali, 2019).

A 3 cc blood sample was taken from the vein using a yellow blood tube, then separated using a centrifuge at a speed of 3000 rpm for 10 minutes. The serum formed is then separated from the blood for examination (Gandasoebrata, 2011). SGPT and SGOT inspections are carried out using the substrate start method. The SPGT examination procedure starts with pipetting 20 µL of serum and putting it into the sample container, after which 1000 µL of R1 reagent is added. Then incubated for 1 minute at 37 ^{o}C. After that, 250 µL of R2 reagent was added and incubated for 3 minutes. Then it is read with a photometer at a wavelength of 340 nm (DiaSys, 2020). Three repetitions were carried out.

The blood SGOT examination procedure starts with pipetting 10 µL of serum and placing it in a sample container, after which 1000 µL of reagent is added. Then incubated for 1 minute at 37 ^{o}C. Then it is read with a photometer at a wavelength of 650 nm (DiaSys, 2020). Three repetitions were carried out. The data obtained from the examination results are subjected to statistical tests with the appearance of the lowest and highest test results to correct errors in the analysis process. The data obtained from the questionnaire is presented in tabular form and the characteristics of the respondents are described, namely age, gender, diet, lifestyle, history of illness and physical activity.

Results and Discussion

The wine obtained in this research came from Besan Village, Dawan District, Klungkung Regency and was produced traditionally. Arak is determined using GC-

FID which aims to determine the compound content in the arak. From the chromatogram results, the ethanol content in wine was obtained with an average of 40.01 ± 0.01% which is presented in Table 1.

Table 1. Ethanol Content in Arak

Arak code	Ethanol content (%)	Average ethanol content (%)	$(X - \bar{X})^2$
A1	40.00		1.0×10^{-4}
A2	40.02	40.01	1.0×10^{-4}
A3	40.01		0
$\bar{X} \pm SD$			40.01 ± 0.01%
%KV			0.025

The arak samples used were repeated three times with a peak appearing at 2.446 to 2.453 minutes with an area between 368.40227 to 368.57594 with the ethanol content obtained being 40.00; 40.02, and 40.01% with an average of 40.01 ± 0.01% and a coefficient of variation of 0.025%. A coefficient of variation value of 0.025% indicates a percentage of inaccuracy of 0.025%. This value has demonstrated accuracy and accuracy with high validity. The results of the ethanol chromatogram on the wine sample are presented in Figure 1.

Based on the results of the analysis, the arak samples that have been analyzed only contain 40% ethanol compounds, including class C liquor, namely alcoholic drinks with 20-55% ethanol content. This group can cause symptoms of severe ataxia, double or blurred vision, fainting, and sometimes convulsions. The wine analyzed did not contain methanol (Frayekti, 2013).

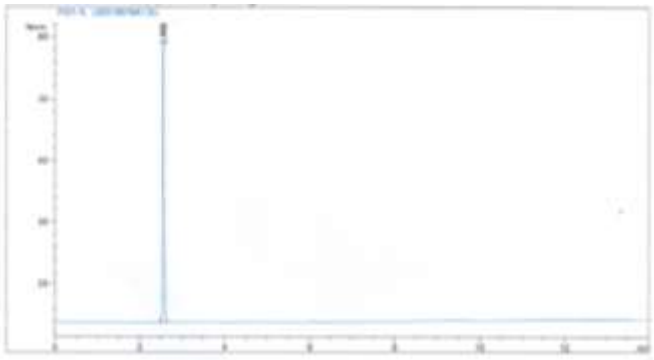

Figure 1. Chromatogram of ethanol in arak samples

In accordance with safety standards for methanol content based on the Regulation of the Head of the Indonesian Food and Drug Monitoring Agency Number 14 of 2016 concerning Safety and Quality Standards for Alcoholic Drinks, the maximum limit for methanol content in alcoholic drinks is no more than 0.01%, so it can be concluded that the methanol content obtained meets the required standards and it is stated that the drink is suitable for trade and consumption. However, if the wine is detected to contain methanol, the symptoms resulting from methanol poisoning can include headaches, digestive tract disorders, anxiety, shortness of breath, blurred vision and even blindness and even death (Paasma et al., 2009). The characteristics of respondents who drink wine in Renon subdistrict, South Denpasar District, Renon Subdistrict, Denpasar City are presented in Table 2.

Table 2. Characteristics of Respondents Based on the Research Questionnaire

Characteristics	Specifications	Number of people	Percentage (%)
Age	< 20 Years	10	33
	21-30 Years	15	50
	31-40 Years	3	10
	> 40 Years	2	7
Weight	< 50 kg	4	13
	51 – 60 kg	10	33
	61 – 70 kg	8	27
	> 70 kg	8	27
Smoking	Yes	30	100
	No	-	-
Eat before consuming arak	Yes	24	80
	No	6	20
Drinking arak for a long time	< 5 Years	11	37
	5–10 Years	10	33
	> 10 Years	9	30
Volume of arak consumption			
Light drinker	< 150 mL	15	50
Heavy Drinker	150-500 mL	10	33
	500-1000 mL	4	13
	> 1000 mL	1	4
History of illness	Yes	1	4
	No	29	96

The sample used was 30 people consisting of 15 people who were light drinkers and 15 people who were heavy drinkers. The drink consumed is wine obtained from the Klungkung area. Based on the results of the questionnaire, all respondents were male in accordance with the provisions of the inclusion criteria. If we look at the age parameter, 33% of respondents were < 20 years old, 50% of respondents were 21-30 years old, 10% were 31-40 years old and only 7% were > 41 years old. 13% of respondents weighed < 50 kg, 33% weighed 51-60 kg, and 27% weighed between 61-70 kg and > 71 kg respectively. Overall all respondents smoked. 80% of respondents ate before consuming wine. The majority, namely 37% of respondents have been drinking since 5 years ago, 33% have been drinking wine for between 5-10 years, and 30% of respondents have been drinking wine for more than 10 years.

Based on the volume parameters of arak consumption, 15 respondents were light drinkers with arak consumption of around 1-3 glasses. Meanwhile, heavy drinkers who consumed between 150-500 mL of wine were 33%, 500-1000 mL were 13% of respondents and those who consumed >1000 mL of wine were 4%. Of the 30 respondents, only 1 person or 4% had a history of the disease, namely gout. The results of examination of serum glutamic pyruvic transaminase (SGPT) and Serum Glutamic Oxaloacetic Transaminase (SGOT) levels and light and heavy drinkers in Renon Village, Denpasar City are presented in Table 3.

Table 3. SGPT Levels of Light Drinkers and Heavy Drinkers in Renon Village, Denpasar City

Drinker characteristics	Reference value	SGPT levels (IU/L) Lowest	Highest	Average
Light drinker	< 40 IU/L	42.0	50.5	46.21 ± 0.155
Heavy Drinker		58.0	69.0	64.02 ± 0.430

Table 4. SGOT Levels of Light Drinkers and Heavy Drinkers in Renon Village, Denpasar City

Drinker characteristics	Reference value	SGOT levels (IU/L) Lowest	Highest	Average
Light drinker	< 40 IU/L	46.0	58.6	50.20 ± 0.101
Heavy Drinker		53.2	88.4	74.40 ± 0.048

Based on Table 3, the SGPT levels of 15 light drinkers had the lowest level of 42.0 IU/L while the highest level was 50.5 IU/L with an average of 46.21 ± 0.155 IU/L. Respondents who drank heavily had the lowest SGPT level of 58.0 IU/L and the highest SGPT level was 69.0 IU/L with an average of 64.02 ± 0.430 IU/L. Overall, all drinkers, both light drinkers and heavy drinkers, had SGPT levels that exceeded the reference value. Table 4 shows that the SGOT level of one light drinker had the lowest level of 46.0 IU/L while the highest level was 58.5 IU/L with an average of 50.20 ± 0.101 IU/L. Respondents who drank heavily had the lowest SGOT level of 53.2 IU/L and the highest SGPT level was 88.4 IU/L with an average of 74.40 ± 0.048 IU/L. Overall, all drinkers, both light drinkers and heavy drinkers, have SGOT levels that exceed the reference value.

SGPT/ALT is an enzyme specific for the liver which only provides significant results in the presence of increased hepatobilliary disease in the liver (Kahar, 2018). SGOT/AST is an enzyme that is not specifically found only in the liver but can also be found in blood cells, heart cells and muscle cells, therefore an increase in SGOT does not always indicate an abnormality in the liver cells (Ghelichpour et al., 2020). Interpretation of normal values carried out by researchers used the normal value of DyaSis reagent, namely < 40 IU/L (DiaSys, 2020). SGPT and SGOT levels increase in liver parenchymal damage, also increase in acute hepatitis, hepatotoxicity causing liver necrosis (drug and chemical toxicity) while slightly increased in liver cirrhosis, liver cancer, congestive heart failure, acute alcohol intoxication, marginal increase, acute myocardial infarction.

SGPT and SGOT levels in drinkers are said to be normal because all chemicals that are included as xenobiotics such as pesticides contained in the blood will be metabolized and biotransformed by the liver (Ortega et al., 2001; Muna et al., 2015). A good biotransformation process of xenobiotics by the liver will reduce or even eliminate levels in the blood that exits the liver before it reaches other organs (Pearce, 2009; Glory et al., 2020). High SGOT levels are a sign of liver damage. This enzyme is an enzyme in mitochondria which is also found in muscles, liver, heart and kidneys (Pizarro et al., 2011). If the tissue experiences acute damage by administering wine, the levels will increase (Andayani et al., 2017; Sarja et al., 2021). This is supported by Jawi et al. (2007) that acute administration of alcohol can increase SGOT and SGPT levels.

A significant increase in SGOT levels occurs in conditions of hepatocellular necrosis or myocardial infarction. Meanwhile, moderate concentrations are found in conditions of damage to skeletal muscles, kidneys and pancreas (Pospos, 2002). Meanwhile, at low concentrations, blood or cellular injury occurs. Therefore, increased SGOT levels are not specifically found in liver damage (Gandasoebrata, 2011). So there is a need for a combination of examination of liver function parameters to assess damage due to ethanol exposure.

Conclusion

Based on the research results, it can be concluded that All SGPT levels for both light and heavy drinkers

exceeded the reference value with an average SGPT level for light drinkers of 46.21 ± 0.155 IU/L, while heavy drinkers had SGPT levels with an average of 64.02 ± 0.430 IU/L, and All SGOT levels for both light and heavy drinkers exceeded the reference value with the average SGOT level for light drinkers being 50.20 ± 0.101 IU/L, while respondents who were heavy drinkers had SGPT levels with an average of 74.40 ± 0.048 IU/L.

Acknowledgements
The researcher would like to thank Bali International University for the grant funds provided in the form of campus competitive grants. So researchers can carry out experimental research in testing alcohol levels in wine samples, enzymatic testing on blood specimens to assess parenchymal damage to the liver.

Authors Contributions
Ni Putu Rahayu Artini conceptualized the research idea, designed of methodology, management, conducted a research and coordination responsibility; I Wayan Tanjung Aryasa analyzed data, conducted an investigation process, conducted literature review and provided critical feedback on the manuscript.

Funding
This research is fully funded by Bali International University in the form of campus competitive grants.

Conflicts of Interest
The author declared no conflict of interest.

References

Amirudin, R. (2009). *Buku Ilmu Penyakit dalam: Fisiologi dan Biokimia Hati*. Edisi V. Jakarta: Interna Publishing.

Andayani, A. A. I., Martono, E., & Muhamad, M. (2017). Pemberdayaan Masyarakat Melalui Pengembangan Desa Wisata dan Implikasinya terhadap Ketahanan Sosial Budaya Wilayah (Studi di Desa Wisata Penglipuran Bali). *Jurnal Ketahanan Nasional*, *23*(1), 1. https://doi.org/10.22146/jkn.18006

Aritonang, I. (2012). *Penyelenggaraan Makanan*. Yogyakarta: Jurusan Gizi Poltekkes.

Astuti, N. P. W., Suaniti, N. M., & Mustika, I. G. (2018). Validasi Metode dalam Penentuan Kadar Etanol pada Arak Menggunakan Kromatografi Gas Detektor Ionisasi Nyala. *Jurnal Kimia (Journal of Chemistry)*, *12*(2), 128-133. https://doi.org/10.24843/JCHEM.2018.v12.i02.p06

Bidlabfor Polda Bali. (2019). *Instruksi Kerja Laboratorium Forensik Cabang Denpasar-Bali*. Retrieved from https://bidlabfor.bali.polri.go.id/

Conreng, D., Waleleng, B. J., & Palar, S. (2014). Hubungan Konsumsi Alkohol dengan Gangguan Fungsi Hati pada Subjek Pria Dewasa Muda di Kelurahan Tateli dan Teling Atas Manado. *Jurnal E-Clinic (eCl)*, *2*(2), 35-46. https://doi.org/10.35790/ecl.v2i2.5026

DiaSys, D. (2020). *Clinical Chemistry SGPT, DiaSys Diagnostic Systems GmbH*. Germany. Retrieved from https://www.diasys-diagnostics.com/products/reagents/clinical-chemistry/

Dorland, W. N. (2008). *Kamus Saku Kedokteran Dorland* (28 ed.). (Hartanto, Y. B., Nirmala, W. K., Ardy, A., & Setiono, S. Eds.) Jakarta: Elsevier.

Farha, R. A., & Eman, A. (2018). Shift Work and the Risk of Cardiovascular Diseases and Metabolic Syndrome among Jordanian Employees. *Oman Medical Journal*, *33*(3), 235-242. https://doi.org/10.5001/omj.2018.43

Frayekti, M. (2013). *Makalah Kromatografi Gas*. Jakarta: Program Studi Teknik Pengolahan Gas PT Badak NGL LNG Academy Jakarta.

Gadallah, M., Hakmi, S., Eldin, W. S., & Mohsen, A. (2017). Association of Rotating Night Shift with Lipid Profile among Nurses in an Egyptian Tertiary University Hospital. *Eastern Mediterranean Health Journal*, *23*(4), 295-307. https://doi.org/10.26719/2017.23.4.295

Gandasoebrata, R. (2011). *Penuntun Laboratorium Klinik*. Jakarta: Dian Rakyat.

Ghelichpour, M., Mirghaed, A. T., Hoseini, S. M., & Jimenez, A. P. (2020). Plasma Antioxidant and Hepatic Enzymes Activity, Thyroid Hormones Alterations and Health Status of Liver Tissue in Common Carp (*Cyprinus carpio*) Exposed to Lufenuron. *Aquaculture*, *516*, 734634. https://doi.org/10.1016/j.aquaculture.2019.734634

Glory, C., Arthur, A., & Hall, E. J. (2020). *Buku Ajar Fisiologi Kedokteran*. Jakarta: Gramedia.

Indrayani, A. A. S. M., Artini, N. P. R., & Aryasa, I. W. T. (2019). Analisis Kadar Trigliserida dan HDL (High Density Lipoprotein) pada Tenaga Farmasi di Apotek Indobat Denpasar. *The Journal of Muhammadiyah Medical Laboratory Technologist*, *2*(2), 18-27. https://doi.org/10.30651/jmlt.v2i2.2581

Jawi, M., Suprapta, D. M., & Sutirtayasa, W. P. (2007). Efek Antioksidan Ekstrak Umbi Ubi Jalar Ungu (*Ipomoiea batatas L*) terhadap Hati setelah Aktivitas Fisik Maksimal dengan Melihat Kadar AST dan ALT Darah pada Mencit. *Dexa Media*, *20*(3), 65-71.

Julia, S. R. (2016). *Efek Minuman Keras Oplosan terhadap Perubahan Histopatologi Lambung Tikus Wistar Jantan* (Undergraduate thesis). Fakultas Kedokteran Universitas Jember, Jember. Retrieved from

https://repository.unej.ac.id/handle/123456789/73581

Kahar, H. (2018). Pengaruh Hemolisis terhadap Kadar Serum Glutamate Pyruvate Transaminase (SGPT) sebagai Salah Satu Parameter Fungsi Hati. *The Journal of Muhammadiyah Medical Laboratory Technologist*, *1*(1), 45-53. https://doi.org/10.30651/jmlt.v1i1.981

Logan, B. K., Case, G. A., & Distefano, S. (1999). Alcohol Content of Beer and Malt Beverages: Forensic Considerations. *J Forensic Sci.*, *44*(6), 1292-1295. Retrieved from https://pubmed.ncbi.nlm.nih.gov/10744486/

Muna, E. D. M., Bizarri, C. H. B., Maciel, J. R. M., Rocha, G. P., & Araujo, I. O. (2015). Method Validation for Methanol Quantification Present in Working Places. *Journal of Physics Conference Series*, *575*(1), 012031. https://doi.org/10.1088/1742-6596/575/1/012031

Ortega, C., López, R., Cacho, J., & Ferreira, V. (2001). Fast Analysis of Important Wine Volatile Compounds Development and Validation of a New Method Based on Gas Chromatographic–Flame Ionisation Detection Analysis of Dichloromethane Microextracts. *Journal of Chromatography A*, *923*(1-2), 205–214. https://doi.org/10.1016/S0021-9673(01)00972-4

Paasma, R., Hovda, K. E., & Jacobsen, D. (2009). Methanol Poisoning and Long Term Sequelae–a Six Years Follow-up after a Large Methanol Outbreak. *BMC Clinical Pharmacology*, *9*(5). https://doi.org/10.1186/1472-6904-9-5

Pearce, E. C. (2009). *Anatomi dan Fisiologi untuk Paramedic*. Jakarta: PT Gramedia Pustaka Umum.

PERPRES. (2013). *Peraturan Presiden Republik Indonesia Nomor 74 Tahun 2013 tentang Pengendalian dan Pengawasan Minuman Beralkohol*. Jakarta: Kemensekneg.

Pizarro, C., Sáenz-González, C., Pérez-del-Notario, N., & González-Sáiz J. M. (2011). Development of a Dispersive LiquidLiquid Microextraction Method for the Simultaneous Determination of the Main Compounds Causing Cork Taint and Brett Character in Wines Using Gas Chromatography-Tandem Mass Spectometry. *Journal of Chromatography A*, *1218*(12), 1576-1584. https://doi.org/10.1016/j.chroma.2011.01.055

Pospos N. (2002). *Alkohol Merusak Sel Hati dan Pengaruhnya terhadap Konsentrasi ATP Intraseluler*. Jakarta: Widya Medika.

Rini, H. S. (2012). *Prilaku Kriminal pada Pecandu Alkohol*. Depok: Fakultas Psikologi Universitas Gunadarma.

Riyanto, R. (2014). *Validasi & Verifikasi Metode Uji: Sesuai dengan ISO/IEC 17025 Laboratorium Pengujian dan Kalibrasi*. Yogyakarta: Deepublish.

Sarja, N. L. A. K. Y., Widana, I. P. K. A., Suprapto, P. A., & Pamularsih, T. R. (2021). Developing Green Tourism-Based Model of Information Technology Utilization in Tourism Villages. *International Journal of Applied Sciences in Tourism and Events*, *5*(2), 153-165. http://dx.doi.org/10.31940/ijaste.v5i2.153-165

Suaniti, N. M., Asih, I. A. R. A., & Astuti, N. P. W. (2012). Deteksi Etanol Setelah Konsumsi Arak dalam Urin dengan Gas Chromatography. *Jurnal Kimia (Journal of Chemistry)*, *6*(2), 123-124. Retrieved from https://ojs.unud.ac.id/index.php/jchem/article/view/5951