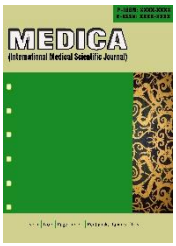
MEDICA

(International Medical Scientific Journal)
Vol.7, No.1, January 2025, pp. 1 – 8
ISSN 2622-660X (Online), ISSN 2622-6596 (Print)
https://journal.ahmareduc.or.id/index.php/medica



Exploring C-Reactive Protein Levels in Menstruating Female Students: A Descriptive Study

Agiesa Khoirunzia[1]✉, Herlinda Djohan[1], Linda Triana[1], Etiek Nurhayati[1]

[1] Department of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Pontianak, Pontianak, West Kalimantan, Indonesia

Info Article

Article History:
Received:
11 December 2024
Accepted:
3 January 2025
Published:
31 January 2025

Keywords:
Menstruation
C-Reactive Protein

Abstract

During menstruation, prostaglandins induce uterine contractions, which contribute to the thickening of the endometrial mucosa and the constriction of blood vessels. Elevated levels of prostaglandins may influence C-Reactive Protein (CRP) levels, a marker that increases in response to inflammation or infection as part of the body's immune response. This study aimed to examine CRP levels in female students during menstruation. A descriptive research design was employed to assess CRP levels in menstruating female students. The sample consisted of blood serum collected from 30 students at Madrasah Aliyah Pondok Pesantren Pembangunan Ushuluddin in Singkawang City. The results showed that among the participants, 5 students aged 16 and 1 student aged 15 exhibited positive CRP levels. Regarding the duration of menstruation, positive CRP levels were detected in 4 students on the first day, 1 student on the second day, and 1 student on the third day. Overall, 20% of the students showed positive CRP levels, while 80% had negative CRP levels. The conclusion indicates that a subset of menstruating female students exhibited elevated CRP levels, particularly during the early days of menstruation. This suggests that menstruation, likely through prostaglandin-induced inflammation, may be associated with an increase in CRP levels in some individuals.

Corresponding Author:
✉ Agiesa Khoirunzia
Department of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Pontianak, Pontianak, West Kalimantan, Indonesia
Email: agiesa.bky1122@gmail.com

1. INTRODUCTION

One in every six people in the world is a teenager. In Indonesia, the number of adolescents and young people is growing rapidly. Between 2000 and the present, the population in the age group of 15-24 years increased from 21 million to 43 million, which is a rise from 18% to 21% of the total population. According to the World Health Organization (WHO), adolescence is defined as the age range between 10 and 19 years (World Health Organization, 2018). Adolescence is a transitional period between childhood and adulthood, encompassing biological, psychological, and social changes. In most societies and cultures, adolescence typically begins between the ages of 11 and 13 and ends around 18 to 22 years of age. This phase is marked by rapid growth, commonly referred to as puberty (Marlia, 2020).

Solehati et al., (2018) states that menstruation is a physiological event for females who have reached adolescence, during which their reproductive hormones begin to function. Menarche is the first menstruation, typically occurring between the ages of 10 and 16, or in the early adolescent phase during puberty, before entering the reproductive years. Menstruation is a process of desquamation, where the endometrium (the inner lining of the uterus) sheds and passes through the vagina along with the release of blood (Pemiliana, 2018). Menstruation is triggered by a sudden decrease in progesterone and estrogen levels at the end of the ovarian cycle. During the menstrual phase, prostaglandins cause uterine muscles to contract, which leads to the thickening of the endometrial mucosa and the constriction of blood vessels.

One of the factors that can affect menstruation is stress. Stress is a physical and psychological response to demands that can cause tension and disrupt the balance of daily activities. Under stress, the HPA (Hypothalamic Pituitary Adrenal) axis is activated, leading the hypothalamus to release CRH (Corticotropic Releasing Hormone), which stimulates the anterior pituitary gland to secrete ACTH (Adrenocorticotropic Hormone). This hormone triggers the adrenal cortex to release cortisol. The secretion of cortisol suppresses the release of GnRH (gonadotropin-releasing hormone) in the hypothalamus, which in turn affects the secretion of LH (luteinizing hormone). This disturbance impacts the production of estrogen and progesterone, ultimately affecting the menstrual cycle (Abbara et al., 2019).

The menstrual cycle is a recurring event from the start of one menstruation period to the end of the next. Lama menstruasi antara 3 sampai 5 hari, namun biasanya menstruasi bisa terjadi antara 7 hari (Lubis et al., 2022). Data from the 2018 Basic Health Research (Riset Kesehatan Dasar) indicates that 68% of Indonesian women aged 10 to 59 experience a regular menstrual cycle, while 13.7% report having menstrual cycle disorders that are irregular over the past year (Zahra et al., 2023). The normal menstrual cycle can be divided into two main phases: the ovarian cycle and the endometrial cycle. The ovarian cycle is further divided into the follicular phase, ovulation, and the luteal phase. Simultaneously, the endometrial cycle is divided into the menstrual phase, proliferative phase, and secretory phase (Faizi, & Kazmi , 2017).

In the early follicular phase of the menstrual cycle, there may be misinterpretation in assessing cardiovascular risk. It has been stated that CRP levels in the early follicular phase are significantly higher compared to CRP levels in the luteal phase during the same cycle (Gursoy et al., 2015). CRP values are significantly higher in the early follicular phase than in the luteal phase. Regarding inflammation markers in dysmenorrhea and therapy options, it is reported that CRP levels are highest during menstruation, decrease during the follicular phase, are lowest around the estimated time of ovulation, and then increase during the luteal phase (Barcikowska et al., 2020). The impact of the menstrual cycle on C-Reactive Protein (CRP) concentrations states that CRP levels are observed to vary in

response to different phases of the menstrual cycle. CRP concentrations tend to be highest during the follicular phase and decrease significantly during the luteal phase. The menstrual cycle may fluctuate each month, leading to menstrual irregularities. Various disorders can occur during, before, or after menstruation, including premenstrual syndrome, dysmenorrhea, menstruation, hypermenorrhea, and others (Vasishta et al., 2017).

Dysmenorrhea is the most common menstrual disorder (Al Mamun et al., 2020). Dysmenorrhea, or menstrual pain, is characterized by sharp pain in the lower abdomen and thighs, which occurs due to an imbalance of the hormone progesterone in the blood, leading to the onset of pain. A study on the difference in hs-CRP levels according to body mass index and the severity of Premenstrual Syndrome (PMS) in adolescents aged 18-24 years found that lower levels of hs-CRP were observed in those with mild PMS compared to those with moderate PMS. This was attributed to the increased levels of estrogen in respondents with moderate PMS, which triggers the production of pro-inflammatory cytokines, supported by the increase in prostaglandins. In this condition, the activation of inflammatory cytokines contributes to the elevation of hs-CRP levels in the liver, acting as a marker of pain, which is a key condition of premenstrual syndrome (Nugrahmi, Serudji, & Almurdi, 2018).

A study involving healthy women found a positive correlation between CRP levels and the severity of menstrual symptoms, with mood changes and pain being the most strongly correlated. In a study on female students with dysmenorrhea at the Medical Laboratory Technology Department of Poltekkes Kemenkes Palembang, it was found that 2 students with mild dysmenorrhea had a 20% positive CRP result, 11 students with moderate dysmenorrhea had a 47.8% positive CRP result, and 3 students with severe dysmenorrhea had a 42.9% positive CRP result. The study concluded that students with mild dysmenorrhea exhibited lower CRP values compared to those with moderate and severe dysmenorrhea (Syafitri, 2022). Typically, the pain felt in the lower abdomen occurs on the first and second days of menstruation (Amalia, 2017).

According to the World Health Organization (WHO), dysmenorrhea affects 8-81% of young women, with a prevalence of 45-97% in Europe and 54.89% in Indonesia. Among these women, 15% report that their daily activities are disrupted (Mandasari, 2021). In Indonesia, 64.25% of women aged 14-19 experience menstrual pain, with 54.89% having primary dysmenorrhea and 9.36% secondary dysmenorrhea. Menstrual pain leads to 14% of adolescents missing school activities. If not managed, dysmenorrhea can negatively impact mental and physical health, causing anxiety, depression, and severe cramps (Realita et al., 2022).

Many Islamic boarding schools (pondok pesantren) not only focus on religious studies but also provide formal education, which adds to the busy schedules of the students (santri) (Dhofier, 2017). While at the pesantren, students are required to manage their lives according to the established rules, including organizing their worship activities, eating habits, rest periods, sleep, and study time, and they are expected to handle their own responsibilities as best as possible. Students live in dormitories with teachers, clerics, and senior students (Rahmawati, 2015). Madrasah Aliyah Pondok Pesantren Pembangunan Ushuluddin in Singkawang City is an accredited A-level Madrasah Aliyah. According to the school's profile data, the study hours for students outside the dormitory run from 06:50 to 15:00 WIB, while for those staying in the dormitory, the schedule extends until 21:00 or 22:00. The tight schedules of the students are related to factors that can cause menstrual disorders. Sandayanti et al. (2019) suggest that psychological factors, such as stress, can cause dysmenorrhea. Stress can disrupt the endocrine system,

leading to irregular menstruation and menstrual pain. Therefore, the researcher chose Madrasah Aliyah Pondok Pesantren Pembangunan Ushuluddin as the research location.

Nehring, Goyal, & Patel (2023) explain that CRP (C-reactive protein) is an acute-phase reactant protein primarily induced by the action of IL-6 on the gene responsible for CRP transcription during the acute phase of inflammation/infection. Haliza et al. (2022) state that CRP is an acute-phase protein produced by the liver (hepatocytes), with normal levels ranging from 0.3 to 1.7 mg/l. An increase in CRP levels in the blood serum indicates uncontrolled infection. CRP levels typically rise due to infection or inflammation as part of the body's immune response. Lubis et al. (2022) mention that adolescent girls are susceptible to reproductive tract infections (RTIs). The aim of this study is to describe the levels of C-reactive protein (CRP) in female students who menstruate.

2. METHOD

The research design used in this study is a descriptive research design aimed at describing CRP levels in female students who menstruate. The population of this study consists of 181 female students from 10th and 11th grades at Madrasah Aliyah Pondok Pesantren Pembangunan Ushuluddin in Singkawang City. The sample size for this study is 22 participants, selected using purposive sampling technique. This research was conducted from October 2023 to July 2024.

The study was carried out at Pondok Pesantren Pembangunan Ushuluddin in Singkawang City, located at Jl. Alianyang No.26, Singkawang Tengah, Singkawang City, West Kalimantan 79113, and at the UPT Puskesmas Singkawang Tengah 1 Laboratory, located at Jl. Salam Diman No. 1, Singkawang Tengah, Singkawang City, West Kalimantan 79111. The data collection methods used in this study include observation, interviews, and questionnaires. The instruments used to support the data in this study are questionnaires, and the instrument for examination is the C-Reactive Protein (CRP) Reagent Kit.

The data analysis used is univariate analysis. Univariate analysis involves frequency distribution tables that present data for a single variable. In this study, the frequency table illustrates the CRP levels in female students from Madrasah Aliyah Pondok Pesantren Pembangunan Ushuluddin Singkawang who menstruate. This study also received ethical approval from the Ethics Committee of the Politeknik Kesehatan Kementerian Kesehatan Pontianak with approval number: 107/KEPK-PK.PKP/III/2024.

3. RESULTS AND DISCUSSION

Table 1. Frequency Distribution of CRP Test Results in Female Students who are Menstruating.

Category	Frequency	Percentage
Positive	6	20.0
Negative	24	80.0
Total	30	100.0

Based on Table 1 above, the researcher obtained the frequency distribution results from 30 female students who were menstruating, with 6 students showing positive CRP results (20%).

Table 2. Frequency Distribution of CRP in Female Students who are Menstruating Based on Age Category

Aged (years)	Frequency	Positive		Negative		Percentage
	F	F	%	F	%	%
15	3	1	3.3	2	6.7	10.0
16	15	5	16.7	10	33.3	50.0
17	12	0	0	12	40.0	40.0
Total	30	6	20.0	24	80.0	100.0

Table 2 shows that the researcher found the highest number of respondents to be 16 years old, with 15 female students (50.0%), of which 16.7% tested positive for CRP. The average age of the respondents was 17 years, with 12 students (40.0%). The minimum age of the respondents was 15 years, accounting for 10.0%, with 3.3% of these students testing positive for CRP.

Table 3. Frequency Distribution of CRP in Female Students who are Menstruating Based on Menstruation Duration Category

Menstruation Duration (days)	Frequency	Positive		Negative		Percent
	F	F	%	F	%	%
1	8	4	13.3	4	13.3	26.7
2	9	1	3.3	8	26.7	30.0
3	3	1	3.3	2	6.7	10.0
4	3	0	0	3	10.0	10.0
5	0	0	0	0	0	0
6	4	0	0	4	13.3	13.3
7	3	0	0	3	10.0	10.0
Total	30	6	20.0	24	80.0	100.0

Based on Table 3 above, the researcher found that out of the 8 female students menstruating on the 1st day, 4 students had positive CRP results, which accounted for 13.3%. Among the 9 female students menstruating on the 2nd day, 1 student had positive CRP results, which accounted for 3.3%. Among the 3 female students menstruating on the 3rd day, 1 student had positive CRP results, which also accounted for 3.3%.

DISCUSSION

Based on the CRP results, which were examined qualitatively using the agglutination method, the data in this study were collected from primary data, meaning the data was obtained directly from the respondents who were the subjects of the research. The study sample consisted of 30 female students who were menstruating at Madrasah Aliyah Pondok Pesantren Pembangunan Ushuluddin in Singkawang City, all of whom met the inclusion and exclusion criteria. The sampling technique used in this study was purposive sampling, where the selected sample met specific criteria relevant to the research. The respondents in this study were female students who were menstruating, with a total sample of 30 participants.

Table 1 presents the frequency distribution of CRP examination results for female students who were menstruating. The results of this study are in line with the findings of Syafitri (2022), who concluded that CRP levels increase during menstruation. In that study, 40% of participants tested positive for CRP. During menstruation, prostaglandins cause muscle contractions, leading to thickening of the endometrial mucosa and narrowing of blood vessels. Prostaglandins play an important role in the inflammatory response. Their biosynthesis significantly increases in inflamed tissues, contributing to the development of

major signs of acute inflammation. This study is consistent with the research by Gaskins et al. (2012), which states that CRP concentrations vary throughout the menstrual cycle, reaching the highest levels and most variability during menstruation. High CRP levels are not only markers of inflammation but also active in the process of atherogenesis and are considered pro-atherosclerotic factors. CRP is not an antibody; it has a biological function involved in inflammation and immune defense mechanisms against infections (Baratawidjaja & Renggaris, 2010).

Table 2 presents the frequency distribution of CRP among female students who menstruate, categorized by age. According to the World Health Organization (WHO), the adolescent age range is between 10-19 years (World Health Organization, 2018). Physically, adolescence is characterized by changes in physical traits and psychological functions, especially those related to reproductive organs, while psychologically, adolescence is a time when individuals experience changes in cognitive, emotional, social, and moral aspects (Kemenkes RI, 2020). This is in line with the findings of Chiang et al. (2019), who concluded that CRP levels increase during mid-adolescence and into young adulthood, with higher levels observed when stress is perceived. This also aligns with Yulistian (2021), who states that age progression is influenced by low-grade pro-inflammatory states, characterized by elevated cytokine and acute-phase protein levels, leading to increased CRP.

Excessive hormone levels in the blood can lead to changes in the menstrual cycle (Chomaria, 2013). Stress can also trigger the release of hormones and peptides that increase prostaglandin production, which stimulates uterine muscle contractions, causing pain during menstruation. This pain can disrupt concentration and negatively impact daily activities, such as missing school, falling behind in lessons, or being unable to attend work.

Table 3 shows the frequency distribution of CRP levels among female students who menstruate, categorized by the duration of menstruation. This study aligns with research by Barcikowska et al. (2020) on inflammatory markers in dysmenorrhea and therapy choices, which states that CRP levels are highest during menstruation, decrease during the follicular phase, are lowest at the expected ovulation day, and increase during the luteal phase. However, this study does not align with the research by Gursoy et al. (2015), who concluded that CRP levels in the early follicular phase of the menstrual cycle (menstruation) are significantly higher than CRP levels in the luteal phase of the same cycle. The menstrual cycle refers to the period from the first day of menstruation to the arrival of the next menstrual period. Menstrual disorders are one of the causes of elevated CRP levels. CRP is a protein produced by the liver, and its levels increase during inflammation in the body. Dysmenorrhea is not only caused by hormonal imbalances but can also be influenced by factors such as exercise and age at menarche. These factors do not necessarily cause increased CRP levels. Khotimah, Kirnantoro, and Cahyawati (2014) state that dysmenorrhea is more common among adolescent girls experiencing anxiety, restlessness, and tension. Stress can affect the menstrual cycle because, during stress, the stress hormone cortisol can disrupt the menstrual cycle by affecting progesterone levels in the body, which also contributes to an increase in prostaglandin levels as a pro-inflammatory cytokine, thus raising CRP levels.

4. CONCLUSION

The conclusion indicates that a subset of menstruating female students exhibited elevated CRP levels, particularly during the early days of menstruation. This suggests that menstruation, likely through prostaglandin-induced inflammation, may be associated with an increase in CRP levels in some individuals. It is recommended that future researchers

conduct further studies on the semi-quantitative levels of CRP in adolescent females who are menstruating by adding more variables and increasing both the population and sample size.

REFERENCES

Abbara, A., Eng, P. C., Phylactou, M., Clarke, S. A., Hunjan, T., Roberts, R., ... & Dhillo, W. S. (2019). Anti-müllerian hormone (AMH) in the diagnosis of menstrual disturbance due to polycystic ovarian syndrome. *Frontiers in endocrinology*, 10, 656. https://doi.org/10.3389/fendo.2019.00656

Al Mamun, A. S. M., Islam, M. A., Malitha, J. M., & Hossain, M. G. (2020). Risk Factors behind Menstrual Disturbance of School Girls (Age 10 To 12 Years) in Rajshahi District, Bangladesh. *Journal of Life Sciences*, 12(1–2). 49-59.

Amalia, A. (2017). Efektivitas terapi musik klasik terhadap nyeri disminorea. *Jurnal Riset Kebidanan Indonesia,* 1(2), 56-62. https://doi.org/10.32536/jrki.v1i2.9

Baratawidjaja, K. G., & Rengganis, I. (2010). *Imunologi Dasar*. Edisi 7. Jakarta: Fakultas Kedokteran Universitas Indonesia.

Barcikowska, Z., Rajkowska-Labon, E., Grzybowska, M. E., Hansdorfer-Korzon, R., & Zorena, K. (2020). Inflammatory markers in dysmenorrhea and therapeutic options. *International journal of environmental research and public health,* 17(4), 1191. https://doi.org/10.3390/ijerph17041191

Chiang, J. J., Park, H., Almeida, D. M., Bower, J. E., Cole, S. W., Irwin, M. R., ... & Fuligni, A. J. (2019). Psychosocial stress and C-reactive protein from mid-adolescence to young adulthood. *Health Psychology*, 38(3), 259-267.

Chomaria, N. (2013). *Tips Jitu dan Praktis Mengusir Stress*. Jogjakarta : Diva Press.

Dhofier, Z. (2017). *Tradisi Pesantren Studi Pandangan Hidup Kyai dan Visinya Mengenai masa depan Indonesia*. Jakarta: LP3ES.

Faizi, N., & Kazmi, S. (2017). Universal health coverage - There is more to it than meets the eye. *Journal of family medicine and primary care, 6*(1), 169–170. https://doi.org/10.4103/jfmpc.jfmpc_13_17

Gaskins, A. J., Wilchesky, M., Mumford, S. L., Whitcomb, B. W., Browne, R. W., Wactawski-Wende, J., Perkins, N. J., & Schisterman, E. F. (2012). Endogenous reproductive hormones and C-reactive protein across the menstrual cycle: the BioCycle Study. *American journal of epidemiology,* 175(5), 423–431. https://doi.org/10.1093/aje/kwr343

Gursoy, A. Y., Caglar, G. S., Kiseli, M., Pabuccu, E., Candar, T., & Demirtas, S. (2015). CRP at early follicular phase of menstrual cycle can cause misinterpretation for cardiovascular risk assessment. *Interventional medicine and applied science*, 7(4), 143-146. https://doi.org/10.1556/1646.7.2015.4.2

Haliza, N. E., Wardani, D. P. K., Sudarsono, T. A., & Mulyanto, A. (2022). Hubungan Kadar C Reactive Protein dengan Jumlah Neutrofil Penderita Tuberkulosis Paru pada Fase Pengobatan 0 dan 6 Bulan di BKPM Purwokerto: Relationship Between C Reactive Protein Levels and the Number of Neutrophils in Pulmonary Tuberculosis Patients with Phases 0 and 6 Months at BKPM Purwokerto. *Jurnal Surya Medika (JSM),* 8(2), 37–44. https://doi.org/10.33084/jsm.v8i2.3480

Kemenkes RI. (2020). Profil Kesehatan Indonesia Tahun 2019. Jakarta: Kementerian Kesehatan RI.

Lubis, M. S., Pramana, C., & Kasjono, H. S. (2022). Pengaruh Penyuluhan Menstruasi Menggunakan Media Booklet Terhadap Pengetahuan Dan Sikap Siswi Dalam Menghadapi Menarche. *Sebatik*, 26(1), 270-276. https://doi.org/10.46984/sebatik.v26i1.1544

Mandasari, P. (2021). Hubungan Indeks Massa Tubuh Dan Usia Menarche Dengan Kejadian

Dismenorea Pada Remaja Putri. *Babul Ilmi Jurnal Ilmiah Multi Science Kesehatan*, 13(2). https://doi.org/10.36729/bi.v13i2.930

Marlia, T. (2020). Hubungan Status Gizi Dengan Menstruasi Dini. *Jurnal Kesehatan*, 11(1), 16-22. https://doi.org/10.38165/jk.v11i1.193

Nehring, S. M., Goyal, A., & Patel, B. C. (2017). *C reactive protein*. Statpearls. St. Petersburg.

Nugrahmi, M. A., Serudji, J. & Almurdi, A. (2018). Perbedaan Kadar HS-CRP Menurut Indeks Massa Tubuh dan Derajat Pramenstrual Syndrome pada Remaja Usia 18 24 Tahun." *Jurnal Ilmiah Universitas Batanghari Jambi*, 18(3), 575-579. https://doi.org/10.33087/jiubj.v18i3.505

Pemiliana, P. D. (2019). Perilaku Remaja Putri Dengan Personal Hygiene Saat Menstruasi Di SMA Etidlandia Medan Tahun 2018. *Gaster*, 17(1), 62-76. https://doi.org/10.30787/gaster.v17i1.341

Realita, F., Endang, S., & Rosita, K.S. (2022). Pengaruh Konsumsi Air Kelapa Hijau Terhadap Penurunan Disminore*. Jurnal International Islamic Medicine Forum*, 1(1), 63-70.

Syafitri, I. (2022). Gambaran Kadar C-Reactive Protein (Crp) Pada Mahasiswi Yang Menstruasi Dengan Dismenorea Di Jurusan Teknologi Laboratorium Medis Poltekkes Kemenkes Palembang. *Karya Tulis Ilmiah*. Poltekkes Kemenkes Palembang

Sandayanti, V., Detty, A. U., & Mino, J. (2019). Hubungan Tingkat Stres dengan Kejadian Dismenorea pada Mahasiswi Kedokteran di Universitas Malahayati Bandar Lampung*. Jurnal Psikologi Malahayati*. 1(1), 35-40. https://doi.org/10.33024/jpm.v1i1.1416

Solehati, T., Trisyani, M., & Kosasih, C. E. (2018). Gambaran pengetahuan, sikap, dan keluhan tentang menstruasi diantara remaja puteri. *Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal)*, 4(2), 86-91. https://doi.org/10.33755/jkk.v4i2.110

Vashishta, S., Gahlot, S., Singh, A., & Goyal, R. (2017). Impact of menstrual cycle phases on C-reactive protein concentrations. *International Journal of Research in Medical Sciences,* 5(3), 1090–1094. https://doi.org/10.18203/2320-6012.ijrms20170667

World Health Organization. (2018). Guidance on Ethical Considerations in Planning and Reviewing Research Studies on Sexual and Reproductive Health in Adolescents. World Health Organization. Retrieved from: https://www.who.int/publications/i/item/9789241508414

Zahra, M.A., Aisyiah., & Intan, A.N. (2023). Analisis Faktor Yang Berhubungan Dengan Siklus Menstruasi Di SMK IT Raflesia Depok*. Jurnal Keperawatan Widya Gantari Indonesia*, 7(1), 7-17. https://doi.org/10.52020/jkwgi.v7i1.5469