

The Effect of Pranayama Yoga Exercise on Eyer Sedimentation Rate (ESR) in Adolescent Girls with Primary Dysmenorrhea

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ABSTRACT

Dysmenorrhea is a common menstrual disorder experienced by adolescent girls and may trigger an inflammatory response in the body, as indicated by an increased erythrocyte sedimentation rate (ESR). One non-pharmacological intervention that may help alleviate this condition is yoga pranayama. This study aimed to analyse the effect of yoga pranayama on reducing ESR levels in adolescents with dysmenorrhea. This study used a pre-experimental design with a one-group pretest-posttest approach. The sample consisted of 31 adolescent girls experiencing dysmenorrhea. The yoga pranayama intervention was conducted over 4 weeks, comprising 8 sessions, each lasting 30 minutes. ESR measurements were obtained before and after the intervention using the Westergren method, and the data were analysed using the Wilcoxon signed-rank test. The results showed a decrease in ESR levels after the intervention, with 48.4% of respondents categorised as normal (10–20 mm/h), although 51.6% remained in the high category (>20 mm/h). Statistical analysis indicated a significant difference between pretest and posttest ESR values. This reduction is associated with the relaxation effects of yoga pranayama, which improve tissue oxygenation, enhance blood circulation, and reduce inflammatory responses caused by increased prostaglandins. In conclusion, yoga pranayama is an effective non-pharmacological therapy for reducing ESR in adolescents with dysmenorrhea.

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Introduction

Dysmenorrhea is one of the most common menstrual disorders experienced by adolescent girls and often causes pain and discomfort that can interfere with daily activities, including reduced quality of life and school attendance. This condition is primarily caused by an increase in prostaglandin production triggered by a decline in estrogen and progesterone levels, leading to excessive uterine contractions. In addition, this process is associated with an inflammatory response in the body, which can be indicated by an elevated erythrocyte sedimentation rate (ESR) as a non-specific marker of inflammation (Tishkowski & Zubair, 2025).

The prevalence of dysmenorrhea is relatively high across different countries. A systematic review reported that its prevalence ranges from 1.7% to 97%, depending on differences in definitions and research methods (WHO, 2022; MacGregor et al., 2023). Globally, approximately 40–70% of women of reproductive age experience dysmenorrhea, with about 10% suffering from severe pain that significantly disrupts daily activities (Meinawati, 2021). Furthermore, around 70–90% of dysmenorrhea cases occur during adolescence. In Indonesia, the 2021 Adolescent Reproductive Health Survey in East

Java reported that 4,653 adolescents experienced dysmenorrhea, with 90.25% classified as primary dysmenorrhea and 9.75% as secondary dysmenorrhea (Christiana et al., 2023).

Management of dysmenorrhea can be approached through both pharmacological and non-pharmacological methods. Pharmacological treatment, such as the use of nonsteroidal anti-inflammatory drugs (NSAIDs), is commonly used to relieve pain; however, long-term use may lead to potential side effects. Therefore, safer and more accessible non-pharmacological alternatives are needed. Various methods, including warm compresses, light exercise, acupressure, aromatherapy, and yoga, have been shown to help reduce menstrual pain through relaxation mechanisms and improved blood circulation (Swandari, 2021).

One emerging non-pharmacological approach is yoga pranayama, a breathing practice focused on breath regulation to promote relaxation and physiological balance. This practice can enhance tissue oxygenation, improve blood circulation, and reduce inflammatory responses by activating the parasympathetic nervous system (Kurt & Yayla, 2025). A preliminary study conducted at SMPN 1 Sidoarjo revealed that out of 43 eighth-grade female students experiencing dysmenorrhea, 31 met the research criteria and reported disrupted learning activities due to menstrual pain. This finding highlights the need for effective, practical interventions in the school setting. Therefore, this study aims to analyse the effect of yoga pranayama exercises on erythrocyte sedimentation rate (ESR) in adolescent girls with primary dysmenorrhea.

Method

This study employed a quantitative research design with a one-group pretest–posttest approach. The study was conducted at SMPN 1 Sidoarjo from April to May 2026, involving 43 eighth-grade female students. A total of 31 adolescent girls who experienced dysmenorrhea were selected as the sample using a purposive sampling technique. The intervention consisted of yoga pranayama exercises conducted over 4 weeks, comprising 8 sessions, each lasting 30 minutes. Measurements of erythrocyte sedimentation rate (ESR) and pain intensity were carried out before and after the intervention. ESR was measured using the Westergren method, while pain intensity was assessed using the Numeric Rating Scale (NRS). Data analysis was performed using both univariate and bivariate approaches. The Wilcoxon signed-rank test was used to assess differences in ESR values before and after the intervention.

Results

This study aimed to analyse the effect of yoga pranayama exercises on the erythrocyte sedimentation rate (ESR) in adolescent girls with primary dysmenorrhea.

Table 1 Presents the Frequency Distribution of Respondent Characteristics

Category	f	%
Age		
10-13 Years	0	0
14-16 Years	31	100
17-19 Years	0	0
Menstrual Volume		
Pad change <2 times/day (hypomenorrhea)	1	3,2
Pad change 3–4 times/day (normal)	30	96,8
Pad change >4 times/day (menorrhagia)	0	0
Dysmenorrhea Pain Scale		
Scale 0	0	0
Scale 1–3	0	0
Scale 4–6	17	54,8
Scale 7-9	14	45,2
Scale 10	0	0
IMT (z-score)		
Underweight (thinness)	2	6,5
Normal	26	83,9
Overweight	1	3,2
Obese	2	6,5

Source: primary data, 2026

Based on Table 1, all respondents were aged 14–16 years (100%), indicating that the age variable was homogeneous and did not confound the results. This homogeneity is advantageous as it minimises biological variations that may influence the menstrual cycle and pain perception. Almost all respondents had a normal menstrual volume (96.8%), suggesting relatively stable menstrual conditions, which supports the study findings. However, this homogeneity also limits comparative analysis across different menstrual volume groups. Regarding dysmenorrhea pain characteristics, the majority of respondents were categorised as experiencing moderate pain (54.8%), while the rest experienced severe pain. This indicates variability in baseline conditions, which may influence the response to the intervention, as respondents with higher pain intensity may have greater potential for improvement. Additionally, the subjective nature of pain assessment may introduce potential bias. Regarding Body Mass Index (BMI), most respondents were in the normal range (83.9%). However, a small proportion were classified as underweight, overweight, and obese. These conditions may act as confounding factors, particularly obesity, which is associated with increased systemic inflammation and hormonal imbalance that can exacerbate menstrual pain. Therefore, these factors should be considered when interpreting the study results as part of its limitations (Harahap et al., 2021).

Table 2 Presents the Distribution of The Frequency of Yoga Pranayama Practice and its Relationship with Erythrocyte Sedimentation Rate (ESR)

Category	f	%
Yoga Pranayama Practice Frequency		
Regular	28	90,3
Irregular	3	9,7
Total	31	100%

Source: primary data, 2026

Based on Table 2, the majority of respondents (28; 90.3%) performed yoga pranayama regularly, while the remaining 3 (9.7%) were categorised as irregular.

Table 3 Presents the Specific Data on Erythrocyte Sedimentation Rate (ESR) Levels Before and After the Yoga Pranayama Intervention

Category	f	%	Sig. (Shapiro-Wilk)
ESR Pre-test			0,003
0-9 mm/hour (low)	0	0	
10-20 mm/hour (normal)	0	0	
>20 mm/hour (high)	31	100	
ESR Post-test			0,052
0-9 mm/hour (low)	0	0	
10-20 mm/hour (normal)	15	48,4	
>20 mm/hour (high)	16	51,6	
Pre-test			0,016
Mild pain (1–3)	0	0	
Moderate pain (4–6)	17	54,8	
Severe pain (7–9)	14	45,2	
Extreme pain (10)	0	0	
Post-test			0,003
Mild pain (1–3)	10	32,3	
Moderate pain (4–6)	19	61,3	
Severe pain (7–9)	2	6,5	
Extreme pain (10)	0	0	

Source: Saphiro Wilk

Based on Table 3, all respondents had erythrocyte sedimentation rate (ESR) levels >20 mm/hour (100%) prior to the intervention, indicating high ESR. After 4 weeks of yoga pranayama (twice a week, 30 minutes per session), a decrease in ESR levels was observed. A total of 48.4% of respondents showed a reduction to the normal category (10–20 mm/hour), while 51.6% remained in the high category, although a decrease was still evident.

In addition, a reduction in menstrual pain intensity was observed. Initially, most respondents experienced moderate (54.8%) or severe (45.2%) pain. After the intervention, the distribution shifted to mild pain (32.3%), moderate pain (61.3%), and severe pain (6.5%), indicating an overall improvement in pain levels. The Shapiro–Wilk normality test indicated that some data were not normally distributed ($p < 0.05$); therefore, a non-parametric statistical test was applied, as it is more appropriate for the data characteristics.

Table 4 Presents the Results of the Wilcoxon Signed-Rank Test.

Variable	Z	p-value (Asymp. Sig. 2-tailed)	Interpretation
ESR level	-6.848	0.000	Significant
Pain Scale	-6,450	0.000	Significant

Source: Wilcoxon Signed-rank Test

Based on Table 4, the results of the Wilcoxon Signed-Rank Test showed that the significance value (Asymp. Sig. 2-tailed) was less than 0.05 ($p < 0.05$), indicating a statistically significant difference between the pretest and posttest values. The use of the Wilcoxon test in this study was appropriate given the non-normal distribution of the data, which made non-parametric analysis more suitable for comparing paired observations. The analysis results demonstrated changes in values among the majority of respondents after the intervention, as reflected by the differences between pretest and posttest measurements. Therefore, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_a) was accepted, indicating that the intervention had a significant effect on the variables studied.

Discussion

Before the yoga pranayama intervention, all respondents had elevated erythrocyte sedimentation rate (ESR) levels (>20 mm/h), indicating active inflammation associated with dysmenorrhea. This condition can be explained by increased prostaglandin production, which triggers excessive uterine contractions and systemic inflammatory responses. In addition, respondents' pain may contribute to physiological stress, elevating stress hormones such as cortisol and adrenaline. These hormonal changes can stimulate the production of pro-inflammatory cytokines, which, in turn, promote erythrocyte aggregation (rouleaux formation), thereby accelerating sedimentation.

After approximately 4 weeks of yoga pranayama intervention, a reduction in ESR levels was observed in a considerable proportion of respondents, with nearly half reaching the normal range. This finding indicates an improvement in inflammatory status. Physiologically, pranayama breathing techniques—characterised by slow, controlled breathing—activate the parasympathetic nervous system while suppressing sympathetic activity. This shift reduces stress hormone levels, particularly cortisol, thereby decreasing the production of pro-inflammatory cytokines such as IL-6 and TNF- α . Furthermore, improved tissue oxygenation and enhanced blood circulation contribute to reduced inflammation. Therefore, yoga pranayama helps lower ESR levels, an indicator of inflammation, in adolescents with dysmenorrhea (Chopra et al., 2023).

Before the intervention, the distribution of pain intensity showed that none of the respondents experienced mild pain (0%). The majority of respondents were categorised as having moderate pain, with 17 respondents (54.8%), while the remaining 14 respondents (45.2%) experienced severe pain. This indicates that most respondents experienced relatively high levels of pain during dysmenorrhea, which could interfere with daily activities and reflects a substantial baseline condition prior to the intervention.

After the intervention, changes in pain distribution were observed. A total of 10 respondents (32.3%) reported mild pain, 19 respondents (61.3%) reported moderate pain, and only 2 respondents (6.5%) reported severe pain. These findings demonstrate a shift toward lower pain intensity, with a notable reduction in the number of respondents experiencing severe pain compared with the pre-intervention condition.

Based on the comparison before and after the intervention, it can be concluded that pain intensity decreased among respondents following the treatment. This improvement is reflected by the emergence of the mild pain category and the substantial decrease in severe pain cases. These results suggest that the intervention contributed to alleviating dysmenorrhea pain, thereby enhancing respondents' comfort and daily functioning.

The results of the Wilcoxon Signed-Rank Test for both pain and erythrocyte sedimentation rate (ESR) variables showed p -values < 0.05 , indicating a statistically significant difference between pre- and post-intervention conditions. This finding demonstrates that both pain intensity and ESR levels decreased following the yoga pranayama intervention. Therefore, the intervention was shown to significantly reduce dysmenorrhea pain and lower inflammatory markers among the respondents.

From a pathophysiological perspective, dysmenorrhea is characterised by increased production of prostaglandins, which trigger excessive uterine contractions, vasoconstriction, and tissue ischemia, ultimately stimulating an inflammatory response. This process elevates plasma protein levels, such as fibrinogen and globulin, which promote erythrocyte aggregation and accelerate sedimentation, thereby increasing ESR as an indicator of inflammation (Jayawardena et al., 2020).

In contrast, yoga pranayama exerts physiological effects by activating the parasympathetic nervous system and suppressing sympathetic activity, thereby eliciting a relaxation response. Controlled breathing techniques help reduce stress hormones such as cortisol, enhance tissue oxygenation, and decrease the production of inflammatory mediators. The reduction in inflammatory response leads to decreased plasma protein levels, thereby slowing erythrocyte sedimentation and lowering ESR values. Thus, yoga pranayama is not only effective in alleviating dysmenorrhea pain but also helps reduce inflammation through physiological mechanisms.

Conclusion

Based on the findings of this study, it can be concluded that yoga pranayama exercises significantly reduce erythrocyte sedimentation rate (ESR) in adolescent girls with dysmenorrhea. Therefore, yoga pranayama can be considered an effective, safe, and easily applicable non-pharmacological therapy for reducing inflammation and alleviating dysmenorrhea symptoms in adolescent girls.

In addition, pain intensity decreased following the intervention. This was reflected in a shift from more severe to milder pain categories, along with a decrease in the number of respondents reporting severe pain. These findings indicate that the intervention reduced dysmenorrhea pain, thereby improving comfort and supporting daily activities among the respondents.

References

- Abidah, S. N., Anggasari, Y., Rahayu, E. P., & Maulidia, E. (2024). The Effect Of Cold Compresses On Dysmenorrhea In Adolescent Women. *Journal Of Health Sciences*, 17(02), 115–121. <https://doi.org/10.33086/Jhs.V17i02.5740>
- Ali. (2025). *Pipet Westergren: Prinsip Kerja, Jenis, Fungsi, Bagian, Cara Penggunaan, Nilai Normal, Dan Cara Pemeliharaan Pada Pipet Westergren*. Ditsalab. <https://www.lemariasam.id/pipet-westergren/>
- Amelia, D. Suci, Tarigan, S. Flora Ninta, & Arsyad, N. (2025). Analisis Pengaruh Metode Abdominal Stretching Exercise Terhadap Penurunan Dismenore Primer Pada Remaja Putri Di Sman 2 Kota Gorontalo. In *Jurnal Kolaboratif Sains: [Nomor Vol (Number [Nomor Issue/Nomor], P. [Halaman Awal-Akhir])]*. <https://jurnal.unismuhpalu.ac.id/index.php/jks/article/view/7516>
- Andini, A. (N.D.). *Perbandingan Laju Endap Darah Dan Jumlah Leukosit Antar Derajat Dismenorea Pada Mahasiswi Jurusan Teknologi Laboratorium Medis Poltekkes Tanjungkarang* (Skripsi/Ka) [Jurusan Teknologi Laboratorium Medis Poltekkes Kemenkes Tanjungkarang Yr - 2023]. Retrieved <https://repository.poltekkes-tjk.ac.id/id/eprint/5136/>
- Anggriani, A., Mulyani, Y., & Pratiwi, L. D. (2021). Pengaruh Terapi Farmakologi Dan Non-Farmakologi Terhadap Penurunan Nyeri Menstruasi Pada Mahasiswi Fakultas Farmasi Universitas Bhakti Kencana Bandung. *Jurnal Riset Kefarmasian Indonesia*, 3(3), 174–188. <https://doi.org/10.33759/Jrki.V3i3.156>

- Anisa, A. (2023). *Kombinasi Sereh Dan Yoga Untuk Mengurangi Nyeri Haid*. 4.
- Aprilia, T. A., Prastia, T. N., & Nasution, A. S. (2022). Hubungan Aktivitas Fisik, Status Gizi Dan Tingkat Stres Dengan Kejadian Dismenore Pada Mahasiswi Di Kota Bogor. *Promotor*, 5(3), 296–309. <https://doi.org/10.32832/Pro.V5i3.6171>
- Astuti, D., Astuti, J., Liza, L., & Maharani, E. A. (2023). Perbandingan Hasil Laju Endap Darah Metode Otomatis Dan Manual Pada Pasien Anaemia. *Anakes : Jurnal Ilmiah Analis Kesehatan*, 9(1), 65–69. <https://doi.org/10.37012/Anakes.V9i1.1254>
- Barcikowska, Z., Rajkowska-Labon, E., Grzybowska, M., 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/Ijerp17041191>
- Chopra, D., Stern, E., Bushell, W. C., & Castle, R. D. (2023). Yoga And Pain: A Mind-Body Complex System. *Frontiers In Pain Research*, 4. <https://doi.org/10.3389/Fpain.2023.1075866>
- Christiana, E., Nindawi, N., & Mufida, Y. R. (2023). Derajat Dismenore Pada Mahasiswi Diii Keperawatan Yang Mengalami Obesitas Di Politeknik Negeri Madura. *Sakti Bidadari (Satuan Bakti Bidan Untuk Negeri)*, 6(2), 84–89. <https://doi.org/10.31102/Bidadari.2023.6.2.84-89>
- Diananda, A. (2021). *Psikologi Remaja Dan Permasalahannya*. [Nama Penerbit]. https://www.researchgate.net/publication/331705902_Psikologi_Remaja_Dan_Permasalahannya
- Dwi, C., & Sayuningrum. (2025). *Perbandingan Efektivitas Terapi Kompres Hangat Dan Gerakan*. 12(8), 1653–1660.
- Fathi, H., Ziada, A., Farghaly, H., Elkhaliq, S., & Elkhawas, H. (2020). The Impact Of Obesity On Inflammatory Markers Used In The Assessment Of Disease Activity In Rheumatoid Arthritis – A Cross-Sectional Study. *Clinical Rheumatology*, 39(8), 2405–2411. <https://doi.org/10.1007/S10067-020-05060-6>
- Harahap, A., Oktaviani, J., Kusdiyah, E., Indah, E., Tan, A., & Dwi, A. (2021). Hubungan Indeks Massatubuh (Imt) Dengan Derajat Dismenore Pada Mahasiswi Kedokteran Fkik Universitas Jambi. *E- Sehad*, 1(2), 18–24.
- Hartanto, D., Matahari, R., & Nurfitra, D. (2020). Modul Edukasi Remaja Generasi Milenial Bergizi. In *Eprints.Uad.Ac.Id*. http://eprints.uad.ac.id/32544/1/Doc_0211211011_85%281%29.pdf
- Hikmah, A. M., & Tarigan, W. M. (2022). Perbedaan Nilai Laju Endap Darah (Led) Dengan Metode Westergreen Manual Dan Automatic Convergys ESR 10s Di Puskesmas Pasar Minggu. *Insologi: Jurnal Sains Dan Teknologi*, 1(5), 669–675. <https://doi.org/10.55123/Insologi.V1i5.1004>
- Itani, R., Soubra, L., Karout, S., Rahme, D., Karout, L., & Khojah, H. M. J. (2022). Primary Dysmenorrhea: Pathophysiology, Diagnosis, And Treatment Updates. *Korean Journal Of Family Medicine*, 43(2), 101–108. <https://doi.org/10.4082/Kjfm.21.0103>
- Jayawardena, R., Ranasinghe, P., Ranawaka, H., Gamage, N., Dissanayake, D., & Misra, A. (2020). Exploring The Therapeutic Benefits Of Pranayama (Yogic Breathing): A Systematic Review. *Int J Yoga*, 13(2), 99–110. https://doi.org/10.4103/Ijoy.Ijoy_37_19
- Jiang, J., Zhuang, Y., Si, S., Cheng, H., Alifu, X., Mo, M., Zhou, H., Liu, H., & Yu, Y. (2023). The Association Of Reproductive Hormones During The Menstrual Period With Primary Dysmenorrhea. *International Journal Of Women's Health*, 15, 1501–1514. <https://doi.org/10.2147/Ijwh.S421950>
- Khotimah, H., & Lintang, S. S. (2022). Terapi Non-Farmakologi Untuk Mengatasi Nyeri Dismenore Pada Remaja Non-Pharmacological Therapy To Overcome Dysmenorrhea Pain In Adolescents. *Faletehan Health Journal*, 9(3), 343–352.
- Kurt, E., & Yayla, A. (2025). The Effects Of Pranayama And Deep Breathing Exercises On Pain And Sleep Quality After Laparoscopic Cholecystectomy. *Nursing & Health Sciences*. <https://doi.org/10.1111/Nhs.70041>

- Macgregor, B., Allaire, C., Bedaiwy, M. A., Yong, P. J., & Bougie, O. (2023). Disease Burden Of Dysmenorrhea: Impact On Life Course Potential. *International Journal Of Women's Health*, 15, 499–509. <https://doi.org/10.2147/Ijwh.S380006>
- Malhotra, V., Javed, D., & Pathak, T. (2024). Effect Of Bhastrika Pranayama On Neuro-Cardiovascular-Respiratory Function Among Yoga Practitioners. *Bioinformation*, 20(11), 1549–1554. <https://pmc.ncbi.nlm.nih.gov/articles/PMC11953524/>
- Munro, M. G., Critchley, H. O. D., & Fraser, I. S. (2011). The Figo Classification Of Causes Of Abnormal Uterine Bleeding In The Reproductive Years. *Fertility And Sterility*, 95(7), 2204–2208.E3. <https://doi.org/10.1016/J.Fertnstert.2011.03.079>
- Nursalam. (2020). *Metodologi Penelitian Ilmu Keperawatan*.
- Obeagu, E. I. (2025). A Narrative Review On The Role Of Il-1 β , Il-8, And The Endometrial Matrix In Heavy Menstrual Bleeding Pathogenesis. *Ann Med Surg (Lond)*, 87(11), 7180–7187. <https://doi.org/10.1097/MS9.00000000000003820>
- Purnamaningrum, Y. E., Kusmiyati, Y., Pervia, M. S., Santikaputri, Y. R., Timur, N. W., Aeni, R. N., Pertiwi, T. A. E., Nafi'ah, I., & Salsabila, A. (2023). *Panduan Posyandu Remaja Poltekkes Kemenkes Yogyakarta*.
- Raju, K. B. (2024). Effect Of Yoga And Pranayama On Physiological Parameters In Medical Students. *Scholars Journal Of Applied Medical Sciences*, 5(6a), 2083–2086. <https://doi.org/10.36347/Sjams.2017.V05i06.011>
- Senthil Kumar, A., & Sridhar, L. (2024). Physiology, Menstrual Cycle. *Statpearls*. <https://www.ncbi.nlm.nih.gov/books/Nbk500020/>
- Situmorang, P. R., & Giawa, M. M. A. (2024). Perbandingan Hasil Pemeriksaan Laju Endap Darah (Led) Metode Westergreen Menggunakan Antikoagulan Natrium Sitrat 3,8% Dengan Antikoagulan Edta Di Stikes Santa Elisabeth Medan Tahun 2023. *Jurnal Kesehatan Masyarakat Inovatif*, 7(2), 18–25.
- Swandari, A. (2021). *Buku Ajar Intervensi Fisioterapi Pada Kasus Dismenore*.
- Tishkowski, K., & Zubair, M. (2025). *Erythrocyte Sedimentation Rate Bt - Statpearls [Internet]*. Statpearls Publishing. <https://www.ncbi.nlm.nih.gov/books/Nbk557485/>
- Wahyudi, W. (2021). *Sop Hematologi Analyzer*.
- Widiastini, L. P., Sumawati, N. M. R., & Udayani, N. P. M. Y. (2023). Comparison Of Pranayama Yoga And Surya Namaskar Yoga Towards Dysmenorrhea In Adolescent Girl. *Jurnal Aisyah : Jurnal Ilmu Kesehatan*, 8(1), 195–200. <https://doi.org/10.30604/Jika.V8i1.1573>
- Wulandari, E., Zakaria, M., Mustofa, V. F., & Aryudaningrum, N. (2025). *Dismenore Primer Di Fakultas Kedokteran Unesa Relationship Between Physical Exercise Frequency With. 11*.
- Wulandari, T. N., & Reba, Y. A. (2022). Layanan Informasi Dengan Media Brosur Untuk Meningkatkan Pemahaman Karier Siswa. *Cenderawasih Journal Of Counseling And Education*, 1(2), 66–78.