



Exposure of *Murottal* of Al-Faatihah, Yaasiin, and Ar-Rahmaan Letter during Pregnancy on Parent Cortisol Levels and Number of Glia Cells in Newborn *Rattus norvegicus*

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Abstract

Background: Anxiety during pregnancy increases the activity of the sympathetic nervous system, which causes the brain to release too much of the hormone cortisol. It is a risk factor that is dangerous for the mother and fetus. Glia cells have an essential function, are irreplaceable, and makeup half of the volume of the brain. Increasing the number of glia is indicative of proper synaptic function and is related to human intelligence. This study aimed to analyze the cortisol levels of the mother *Rattus norvegicus* and the number of Glia cells in *Rattus norvegicus* newborn, which *murottal* using letter of Al-Fatihaah explained, Yaasiin, Ar-Rahmaan and was not given exposure **Methods:** The study design was an experimental research method used the post-test only control group. Provision of *murottal* stimulation of Al-Fatihaah, Yaasiin, Ar-Rahmaan. *Rattus norvegicus* terminated and cortisol levels were measured in the blood in the morning at 09.00 using the ELIZA method while *Rattus norvegicus* was just born decapitated and brain dissected, the number of glial cells was counted using Hematoxylin - Eosin and analyzed statistically. **Results:** The results showed differences in cortisol levels between groups of *Rattus norvegicus* parents, with the lowest average cortisol on exposure to Al-Faatihah *murottal*. There were differences in the number



of cerebellum of newborn *Rattus norvegicus* between groups. **Conclusion:** In conclusion, there was a significant difference in parental cortisol levels of *Rattus norvegicus* between groups with the lowest cortisol levels in the Al-Faatihah *murottal* group and the highest number of *Rattus norvegicus* in the Al-Faatihah *murottal* group.

Keywords: *murottal*, *Rattus norvegicus*, glial cells, cortisol, human and health

Introduction

Pregnancy is a time of transition and complex physical changes that can cause anxiety (Trisiani, 2016). Various studies on anxiety during pregnancy in the world report high prevalence rates ranging from 14% to 54% (Madhavanprabhakaran et al., 2015). Anxiety in pregnancy causes an increase in the work of the sympathetic nervous system, which makes the brain release the hormone cortisol excessively. Anxiety or stress in pregnancy is a risk factor for harm to the mother and fetus, such as preterm delivery, stunted fetal growth, and poor fetal neurodevelopment (Dunkel Schetter and Tanner, 2012). Cortisol levels in the blood can measure stress conditions. Cortisol is the primary glucocorticoid synthesized in the zona fasciculata of the adrenal cortex (Lee et al., 2015). Cortisol secretion is regulated by the HPA axis, which consists of *Corticotropin-Releasing Hormone* (CRH), *Adrenocorticotrophic Hormone* (ACTH), and *Hypothalamus-Pituitary-Adrenal* (HPA). The normal value for serum cortisol levels is 3.95-27.23 g/dL (Hsieh et al., 2022). The average cortisol level in pregnant women is around 65.6 nanograms per milliliter (ng/mL) (Nenke et al., 2017). Cortisol levels *Rattus norvegicus* around 20-40 ng/ml in repeated measurements for 14

days (Horii et al., 2017). The cortisol level of *Rattus norvegicus* (terminated on the 20th day of gestation) is around 310-329 ng/ml (Vrijkotte et al., 2023).

Cortisol is a stress hormone involved in responses to physical or emotional stress and affects the immune system, blood pressure, and metabolic rate (Yoshio et al., 2015). Various studies have proven cortisol levels in response to music as a prevention and therapy for excessive anxiety and stress (Koelsch et al., 2011). Listening to music and quiet sounds has been shown to stabilize the physical and psychological condition of the mother during pregnancy (Kurniasari et al., 2017). Exposure to music reduces anxiety-related behaviors and increases immune responses (Kühlmann et al., 2018).

Rhythms *murottal* have a relaxing effect and will be able to generate delta waves in the frontal and central areas to the right and left of the brain. Research by Japakeeya et al. (2021) shows that *murottal* can reduce stress during pregnancy with a measuring tool using a questionnaire. *Murottal* Al-Quran Ar-Rahmaan Letter is one of the sounds that have a positive and calming effect (Kurniasari et al., 2017). *murottals* used in this study are Surat Al-Faatihah, Yaasiin, and Ar-Rahmaan. The first letter, Al-



Faatihah, is the most popular and is often memorized because this letter is one of the requirements for the validity of prayer for Muslims (Japakeeya et al., 2021). The second letter, the Yaasiin letter, is an Islamic method that is believed to provide relaxation and is usually done to reduce the anxiety level of pregnant women (Rahman, 2020). The third letter, Ar-Rahmaan, is a letter of love with the character of a short verse, which, when played, can relax listeners (Pratiwi et al., 2015).

Intelligence is a biopsychosocial potential related to innervation, known from the number of neurons, glia, dendrites, synapses, and the ratio of glia to neurons (Juwono, 2013). The cerebellum has more complex functions such as attentional control, emotional control, social skills, and a role in motor function abilities. The system in the brain can work well if the neuron and glial cells work well together (Rotenstein et al., 2009). Glia cells have an essential function and cannot be replaced and contribute half of the volume of the brain. Glia cells function as controllers of synapse formation, which play a role in nerve activity. An increase in glia indicates functioning synapses that can be linked to human intelligence (Allen and Lyons, 2018; Kim et al., 2020).

Music stimulation the fetus receives will stimulate hearing then calcium signals are sent by the nervous system to the brain (Sanyal et al., 2013). In the brain, calcium signals are processed

and will produce a protein that plays a role in glial cell growth (Chaudhury et al., 2013).

Listening to *Murottal* Al-Qur'an is believed to have a better impact during pregnancy, so it is essential to study it more deeply because it will indirectly affect the growth and development of the fetus. Research on *murottal* to parental cortisol levels and the number of cerebellum glial cells *Rattus norvegicus* of newborn This is done to improve the welfare of the mother and fetus during pregnancy.

Methods

This study was an experimental study with a *post-test-only control group design*. The sample in this study was *Rattus norvegicus*, aged 2-3 months. Mice were exposed to *murottal* Al-Qur'an Al-Faatihah, Yaasiin, and Ar-Rahmaan Letter for ten days within 1 hour in a soundproof box. Pregnancy was carried out by injection of PMSG 10 IU, HCG 10 IU, and monomating. Randomized into five groups. The sample size for each group was 8. The treatment was given on the 9th-19th day of pregnancy, for 1 hour in a soundproof room, with an intensity of 65 Db. *Rattus norvegicus* terminated and cortisol levels were measured in the blood in the morning at 09.00 using the ELIZA method. Meanwhile, *Rattus norvegicus*, newborn Hematoxylin - Eosin, and then from these readings, a calculation was made using statistical analysis. The research location is experimental animal



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the Enzyme-linked immunosorbent assay (ELISA) Cortisol antibody kit. The results can be shown in Table 1.

Results

Cortisol levels were known when examining

Table 1. Mean and standard deviation of cortisol levels (ng/mL) of *Rattus norvegicus* exposed to *murottal* Al-Faatihah, Yaasiin, Ar-Rahmaan, and control

Group	n	Cortisol levels		
		Mean	±	SD
<i>Murottal</i> Al-Faatihah Letter	8	1.78		1.07
<i>Murottal</i> Yaasiin Letter	8	2.41		1.52
<i>Murottal</i> Ar-Rahmaan Letter	8	2.15		0.82
Control	8	5.56		3.90

Table 1 shows the results of the highest mean cortisol levels of *Rattus norvegicus* in the group without exposure or control (5.56 ± 3.90). At the same time, the lowest cortisol average was in exposure to Al-Faatihah's *murottal* Letter (1.78 ± 1.07). The following is a *scatterplot* of the average cortisol levels of *Rattus norvegicus*.

Then a normality test was carried out to test the distribution of the data distribution using the Shapiro-Wilk test with the normality test results as follows.

Table 2. Results of the Shapiro-Wilk for cortisol levels of the parent *norvegicus* -Faatihah, Yaasiin, Ar Rahmaan.

Group	
Al	-
<i>murottal</i>	and
Rahmaan	control
<i>Rattus</i>	normality

Table 2 shows the cortisol levels of *Rattus norvegicus* newborn ANOVA parametric statistics.



Table 3 Significance test of *murottal* Al-Faatihah, Yaasiin, and Ar-Rahmaan letter on parental cortisol levels *Rattus norvegicus*

Group	P value Post Hoc LSD			P value <i>Murottal</i> Anova test
	Yasiin Letter	Ar Rahmaan Letter	Control	
<i>Murottal</i> of Al-Faatihah Letter	0.568	0.739	0.002	0.007
<i>Murottal</i> of Yaasiin Letter		0.811	0.008	
<i>Murottal</i> of Ar-Rahmaan Letter			0.004	

Information: ANOVA test, LSD Post Hoc test (p <0.05)

Based on table 3, the ANOVA above obtained a p = 0.007 (p <0.05), meaning that there is a significant difference in cortisol levels in the parent given exposure to the Al- Faatihah, Surat Yaasiin, Ar Rahman Letter and without treatment or control. The results of the LSD Post-Hoc test showed significant differences in the cortisol levels of *Rattus norvegicus* newborns value of p<005 was obtained in all exposure groups of *Murottal* Al-Faatihah (p=0.002), Yaasiin (p=0.008), Ar-Rahmaan (p=0.004) compared to the control group or no exposure.

Glial cells cerebellum obtained by counting the number of microglial cells, oligodendrocytes, and *Rattus norvegicus* cerebellum in 5 fields of view with 400x magnification using the Image Raster Optilab Camera 60 Mp Microscope Nikon e100. Glial cells can be identified when performing a Hematoxylin-Eosin with dark blue cell nuclei. The following results can be shown:

Table 4. Mean, and standard deviation of the number of glial cells (microglia, oligodendrocytes, and astrocytes) in the cerebellum *Rattus norvegicus* was born from parents exposed to *murottal* of Al-Faatihah, Yaasiin, Ar-Rahmaan Letter and without exposure



Group	n	Number of Glial Cells								
		Microglia			Oligodendrocytes			Astrocytes		
		Mean	±	SD	Mean	±	SD	Mean	±	SD
<i>Murottal</i> Al-Faatihah Letter	8	6.10		0.84	31.42		8.41	155.4		53.7
<i>Murottal</i> Yaasiin Letter	8	6.25		1.62	27.92		2.56	129.7		39.5
<i>Murottal</i> Ar-Rahmaan Letter	8	5.85		0.95	25.27		2.56	151.3		72.0
Control	8	4.27		0.91	18.92		3.44	76.0		19,6

Table 4 shows that the highest mean number of microglia was in the group exposed to Al-Faatihah *murottal* (6.10 ± 0.84), and the lowest was in the control group (4.27 ± 9.91). The highest mean number of oligodendrocytes was in the Al-Faatihah *murottal* exposure group (31.42 ± 8.41) and the lowest in the control group (18.92 ± 3.44). The highest mean number of astrocytes was in the Al-Faatihah *murottal* exposure group (155.4 ± 53.7), and the lowest was in the control group (76.0 ± 19.6)

Then, a normality test was performed using the Shapiro Wilk test with the following normality test results:

Table 5 Shapiro-Wilk Number of Glia cells (microglia, oligodendrocytes, and astrocytes) in cerebellum *Rattus norvegicus* newborns from mothers exposed to *murottal* of Al-Faatihah, Yaasiin, Ar-Rahmaan Letter and without exposure

Group	P value



Microglia	<i>Murottal</i> of Al-Faatihah Letter	0.134
	<i>Murottal</i> of Yaasiin Letter	0.622
	<i>Murottal</i> of Ar-Rahmaan Letter	0.458
	Control	<i>Murottal</i>
Oligodendrocytes	<i>Murottal</i> of Al-Faatihah Letter	0.162
	<i>Murottal</i> of Yaasiin Letter	0.352 <i>Murottal</i>
	<i>Murottal</i> of Ar-Rahmaan Letter	0.439
	Control	0.571
Astrocytes	<i>Murottal</i> of Al-Faatihah Letter	<i>Murottal</i>
	<i>Murottal</i> of Yaasiin Letter	0.499
	<i>Murottal</i> of Ar-Rahmaan Letter	0.573
	Control	0.299

Based on table 5, it is known that the number of glial cells (microglia, oligodendrocytes, and astrocytes) in *Rattus norvegicus* cerebellum newborn ANOVA.

Table 6 Significance test of *murottal* of Al-Faatihah, Yaasiin, and Ar-Rahmaan Letter on the number of Glia (microglia, oligodendrocytes, astrocytes) in *Rattus norvegicus* cerebellum *Murottal* newborn

Kelompok <i>Murottal</i> surat		Nilai p Post Hoc LSD			Nilai p Uji Anova
		Yasiin	Ar Rahmaan	Kontrol	
Mikroglia	Al- Faatihah	0.792	0.661	0.003	0.006



	Yaasiin		0.485	0.002	
	Ar-Rahmaan			0.009	
Oligodendrosit	Al- Faatihah	0.186	0.024	0.000	0.000
	Yaasiin		0.313	0.002	
	Ar-Rahmaan			0.020	
Astrosit	Al- Faatihah	0.313	0.870	0.004	0.014
	Yaasiin		0.395	0.041	
	Ar-Rahmaan			0.006	

Anova test, LSD Post Hoc Test ($p < 0.05$)

Based on table 6, the ANOVA above found that in microglia, the value was $p = 0.006$ ($p < 0.05$), in oligodendrocytes, $p = 0.000$ ($p < 0.05$), and for astrocytes, $p = 0.014$ ($p < 0.05$) meaning that there is a significant difference in the number of the cerebellum (microglia, oligodendrocytes, and astrocytes) newborns whose parents were exposed to *murottal* Al-Faatihah, Surat Yaasiin, Ar Rahman Letter and without treatment or control .analysis was carried Post Hoc LSD (Least Significant Difference) out to find out whether there were differences in each group.

Glial cells (microglia, oligodendrocytes, astrocytes) cerebellum *Rattus norvegicus* Newborn In microglia, $p < 0.05$ was found in all exposure groups of *murottal* of Al-Faatihah ($p = 0.003$), Yaasiin ($p = 0.002$), Ar-Rahmaan ($p = 0.009$) compared to the control group or no exposure. In oligodendrocytes, $p < 0.05$ was found in all exposure groups of *Murottal* Al-Faatihah ($p = 0.000$), Yaasiin ($p = 0.002$), Ar-Rahmaan ($p = 0.020$) compared to the control group or no exposure. For astrocytes, a $p < 0.05$ value was found in all exposure groups of

Murottal Al-Faatihah ($p = 0.004$), Yaasiin ($p = 0.041$), Ar-Rahmaan ($p = 0.006$) compared to the control group or no exposure.

Discussion

Cortisol Levels of Parent *Rattus norvegicus*

In the results of this study, the mean cortisol levels were higher in the control group or without exposure. Meanwhile, the lowest cortisol levels in the parent *Rattus norvegicus* were in the group exposed to Al-Faatihah *murottal*. The statistical analysis results obtained $p < 0.05$, meaning that there was a significant difference between each exposure group (exposure to the control group or no exposure). This research is in line with previous research conducted by which explained that there is a change in alpha brain waves when someone listens to *murottal* Al-Qur'an (Silabdi et al., 2021). This change in alpha waves causes increased concentration and comfort. This convenience causes a decrease in cortisol levels in the *Rattus norvegicus*, who are given *murottal* Al-Qur'an. Cortisol has several roles in the body: mediating stress



response, regulation of metabolism, inflammatory response, and immune function. Cortisol released by the adrenal cortex will remind the body when there are internal and external stressors.

Murottal Al-Qur'an is one of the therapies to overcome anxiety. The results of research by Andarini (2015) in Atmaja & Saputra (2020) show that patients with moderate and severe anxiety levels after being listened to *murottal* Al-Qur'an Ar-Rahmaan Letter for 20 minutes experience changes to mild levels of anxiety due to increased levels of endorphins (Atmaja and Saputra, 2020). This research is in line with previous research, which states that *murottal* Al-Qur'an can reduce stress and anxiety so that cortisol levels in the blood can be lowered (Samhani et al., 2019).

Number of glial *rattus* cerebellum

Cells (microglia, oligodendrocytes, astrocytes) in *norvegicus* newborns whose parents were exposed to *murottal* Al-Faatihah, Yaasiin, Ar-Rahmaan Letter and without treatment. It follows previous research (Rahayu et al., 2019) that found the effect of giving music with the appropriate rhythm and frequency (Mozart) on the number of glia in the brain due to the sensitivity of the frequency that the ear can only receive. The study explained that the cochlea will easily capture the music with a frequency of 5000-8000 Hz (Mozart) to cause a good response in the brain. The results of this study are also following research conducted by samhani et al. namely the effect of *murottal* Al-Qur'an recitation,

which can help stimulate the formation of elements in the brain compared to without being given *murottal* Al-Qur'an recitation (Samhani et al., 2019). So it is true that exposure to *murottal* Al-Fatihaah, Yaasiin, and Ar-Rahmaan can increase the formation of the *Rattus norvegicus* newborn in the cerebellum can increase. The results of this study were linear with previous studies, which showed that intervention using Mozart music with an intensity of 65 dB for 1 hour from the 10th day of gestation in *Rattus norvegicus* could significantly increase the number of glial cells compared to groups exposed to pop and religious music (Rahayu et al., 2019). It may be related to the notes' intensity, rhythm, frequency, and musical composition. Furthermore, Rahayu *et al.* explained that Mozart's music has a rhythm of 60-80 beats per minute, a frequency of 5000-8000 Hz, and the main constituent of the musical notation is the primary notation. In *murottal* Al-Qur'an, letters have characteristics in common with Mozart music: the rhythm is 60-70 beats per minute (Kurniasari et al., 2017). The rhythm of music with a beat of 60-80 times per minute, similar to the beat of the mother's heartbeat, is believed to provide a promising intervention for the growth and development of the fetus (Juwono, 2013). In addition, the range of music frequency values within certain limits will be responded to differently by the brain, where the basilar membrane structure at the base of the chinchilla cochlea of the brain is sensitive to the



frequency of 8000 Hz, which plays a role in charging brain cells (Juwono, 2013; Rahayu et al., 2019).

A significant relationship was found between the two groups being compared, namely the Al-Faatihah *murottal* group and the group without exposure with a p-value <0.05. The *murottal* test analysis obtained a tempo of 120 Bpm with a frequency range of 114-12500Hz. According research (Samhani and Reza, 2017), it was found that Al-Faatihah can reduce stress levels in children who will undergo exams. It is because the brain is distracted by Al-Faatihah verses which make children more comfortable (Koelsch et al., 2011; Lee et al., 2015; Samhani et al., 2019). This feeling of comfort makes alpha waves in the brain relax. If parent *Rattus norvegicus*, it can also affect the fetus it contains in the process of synaptogenesis, which eventually forms a more significant number of glial.

CONCLUSION

There are differences in parental cortisol levels of *Rattus norvegicus* due to exposure to *murottal* Al-Quran Al-Faatihah, Yaasiin, and Ar-Rahmaan during pregnancy compared to those who are not exposed. There are differences in the number of glial cells (microglia, oligodendrocytes, and astrocytes) in the cerebellum *Rattus norvegicus* newborns exposed to *murottal* Al-Faatihah, Yaasiin, Ar-Rahmaan Letter during pregnancy compared to those who were not exposed. Further research is needed on the effect of exposure *murottal* Al-

Faatihah, Yaasiin, and Ar-Rahmaan Letter during pregnancy on the parent hormone Endorphins *Rattus norvegicus* and also on the weight of the mother and *Rattus norvegicus* newborn

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