ORIGINAL ARTICLE

Bali Medical Journal (*Bali MedJ)* 2022, Volume 11, Number 2: 994-1002
P-ISSN.2089-1180, E-ISSN: 2302-2914

Quran recitation as noise-induced aggression and resilience in animal model of depression

Hafid Algristian[1,2*], Tri Wahyuni Bintarti[2], Iradatus Solihah[2], Andik Ferdiantoro[2], Fatmanagri Napstyawati[2], Retno Handajani[1]

[1]Universitas Airlangga, Surabaya, Indonesia;
[2]Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia;

*Corresponding author:
Hafid Algristian;
Universitas Nahdlatul Ulama, Surabaya, Indonesia;
dr.hafid@unusa.ac.id

Received: 2022-06-17
Accepted: 2022-07-28
Published: 2022-08-24

ABSTRACT

Introduction: This research analyzes the behavioral and biological concepts of depression, aggression, and resilience. It also analyzes the Quran recitation as a noise-inducer for aggression but also encouraging intervention for depression.
Method: Experimental research with a post-test-only control group design created an agitated depression model in mice as a basis for understanding the biological concepts of aggression. Healthy mice (Mus musculus balb/c) aged 10-12 weeks, weighing 20-25 grams, were random-allocated into 9 (nine) groups, namely the control group (K_ negative, depression, and aggression), depression group (DP_1, 2, 3), and aggression group (AP_1, 2, 3). The tail suspension approach triggered helplessness to form a depression model. Quran recitation was performed above 60 decibels as noise exposure triggers agitation and forms an aggression model. QRP performed under 60 decibels was assumed to create a resilience model. Depression, aggression, and resilience were measured using an eight-arm radial maze (TM) and immobile time when hung (TG). After the intervention, mice were sacrified and the brains harvested. Normal cells were counted in the average of ten microscopic fields using 40x objective lens magnification and HE staining.
Results: The QRP alleviated the psychomotor retardation in the depression group, while the aggression group experienced a goal-directed behavioral activation as the cognition increased with psychomotor calm. Neuron cells were significantly different among groups; the optimum QRP dose was an hour once a day.
Conclusions: The QRP intervention can improve depression and aggression, but also a source of noise-induced stress at a higher frequency. These results should be carefully generalized and need further research.

Keywords: *Depression, agitated depression, aggression, resilience, mice model*.
Cite This Article: Algristian, H., Bintarti, T.W., Solihah, I., Ferdiantoro, A., Napstyawati, F., Handajani, R. 2022. Quran recitation as noise-induced aggression and resilience in animal model of depression. *Bali Medical Journal* 11(2): 994-1002. DOI: 10.15562/bmj.v11i2.3432

INTRODUCTION

The benefits of Quran recitation can be very subjective for the individual. Muslim scholars recommend recitate the Quran slowly and melodically (*tartil*), following the way of pronouncing (*tajweed*), not too loud, and not too hurry. It is intended so that the melodic effect itself has a positive impact on reconciling the hearts of the reciters.[1] A systematic literature study states that Quran recitation (later will be mentioned as Quran recitation approach, QRP) is useful for relieving anxiety for specific medical condition[2] as well as psychosocial ones.[3] Biologically, QRP can increase chemotherapy response to cancer.[4] Another study mentioned the benefits of QRP on brain relaxation as shown by electroencephalography (EEG)[5], even though the subjects did not understand what was read/listened to.[6] QRP also increases serotonin levels in stroke patients, improving clinical outcomes.[7] Until now, there has been no research yet on how the brain cells respond to QRP, specifically in conditions of depression. It was previously known that there is a political stigma against QRP because it is considered to trigger agitation and aggression.[8,9] Agitation and aggression could be another effect that should be addressed as awareness of any novel therapeutic methods. Studies mention the therapeutic effect of QRP, but none has yet explained whether there are potential side effects. This study tries to analyze how the depressive brain responds to QRP, whether to induce agitation or not, especially when QRP is performed in a soft and appropriate melody for a depressed individual.

METHODS

Research design

This research is an experimental laboratory study with a post-test-only control group design that tried to make a depression model in mice as a basis for understanding the biological concepts of aggression and resilience. Aggression is behavior that originates from an agitated-depression state, while resilience is interpreted as the improvement from an agitated-depression state.

Behavioral data

This study used healthy mice (*Mus musculus* balb/c) aged 10-12 weeks, weighing 20-25 grams. Mice were randomly allocated into 9 (nine) groups, namely the negative control group (K_NEG), the positive depression control group (KD_POS), the

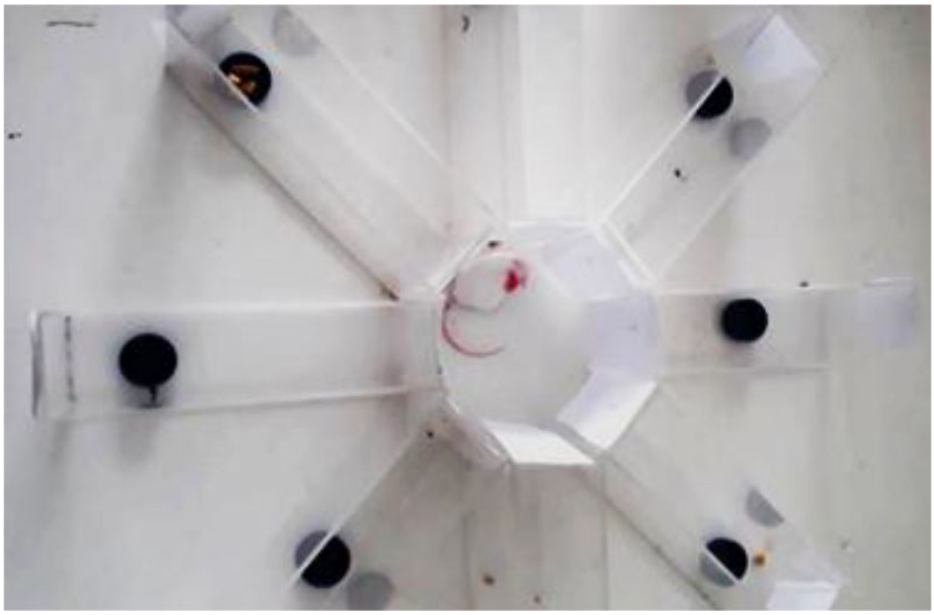

Figure 1. Radial eight-arm maze. Mice are placed in the middle of the maze, with a border on each arm. Mice are positioned against the pellet.

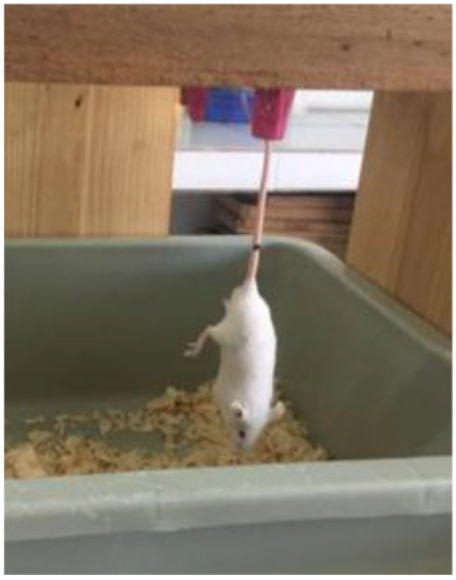

Figure 2. Tail suspension approach.

positive aggression control group (KA_POS), the depression group (DP_1, DP_2, DP_3), and the aggression group-1 (AP_1, AP_2, AP_3). The intervention uses QRP in various doses. The group-1 (DP_1 and AP_1) receives a QRP dose once a day for 1 (one) hour in the morning, the group-2 (DP_2 and AP_2) receives a QRP dose 2 (two) times a day for 1 (one) hour in the morning and evening, and the group-3 (DP_3 and AP_3) received a dose of 2 (two) times a day for 2 (two) hours in the morning and evening.

The radial maze method is used to measure the time the mice found food (pellets) placed in one of the 8 (eight) radial maze arms, where previously the mice were placed in the middle of the maze with their backs to the arms given the pellets.[10] The time of mice in finding pellets illustrates the spatial memory of mice. This research used a simple method to measure "maze time" (TM), which is how many seconds mice had to take to find food. This spatial memory of mice results from odor stimuli captured by the olfactory nerve. This nerve is a highly developed part located in the front of the brain and connected directly to the frontal cortex, thus assumed as a cognitive function of mice.

Behavioral model

This research used the tail suspension approach and noise exposure methods to create models of depression and agitation. The tail suspension approach triggers a forced helplessness condition in mice.[11] This research used a longer time of tail hanging for 1 (one) hour. Mice will experience the helplessness of not being able to lift its body. This exposure is given for 7 (seven) consecutive days, in the morning around 07.30 AM. Mice are nocturnal beings, where morning is rest time and night is active time. The timing of the morning exposure is considered sufficient to disturb the resting time of the mice so that double stress occurs, which is hung and carried out during the resting time of the mice (morning). The standard for hanging mice should be 50 cm from the floor. This study hung mice only as high as the top of the cage (about 15-20 cm from the floor) to anticipate impact trauma due to falling mice from the height.

The tail suspension test was also used to measure the immobile time of mice during a minute hanging that showed helplessness.[12] The difference between the tail suspension approach and the test was that the approach was used to provoke helplessness in an hour while the tail suspension test measured helplessness in a minute. Helplessness was measured by how many seconds mice experienced immobility during the tail suspension test (TG).

The QRP intervention used *muratal Surah Al-Baqarah* by *Qari Al-Mathrud*. This surah was chosen because it could last an hour without excessive repetition. The QRP intervention used frequency below 60 decibels (dB), while noise exposure was above 60 decibels (dB). Noise naturally threatens mice, resulting in agitation behaviors marked by anxiety and excessive vigilance. Mice have a hearing threshold below the frequency of 60 dB, which is more than what is considered noisy. The noise intended as therapy is given less than 60 dB frequency. The frequency measurement uses the Soundmeter application downloaded free on Android phones. Exposure is given for 1 (one) hour per day during the morning around 07.30, for 7 (seven) consecutive days. This exposure is performed in the second week after the tail suspension approach is completed.

Different exposures are intended to make depression an as basic model, then aggression model. The depression model is created via the tail suspension approach, and aggression is made with noise exposure. It was hypothesized that aggression originates from the symptoms of depression with agitation. Aggressive individuals may experience helplessness among external threats, and express excessive vigilance as adaptive responses. Both depression and aggression models received QRP with the same dose in each group, so based on the research

flow in Figure 4, 1 (one) negative control group, 4 (four) depression groups, and 4 (four) treatment groups were created. Exposure (tail suspension and noise) was administered within 7 (seven) days each. A preliminary study shows mice died when exposure was given for 14 days each (total of 28 days). Even though the exposure has been reduced, it can still be considered chronic exposure (chronic stress) because the total exposure is 14 days. Using Federer's formula, the sample size was 4 (four).

$(n-1)(r-1) \geq 15$
$(n-1)(9-1) \geq 15$
$(n-1)(8) \geq 15$
$8n-8 \geq 15$
$8n \geq 23$
$n \simeq 4$

The n is the number of samples per group, and r is the replication or number of groups. This study used nine groups (Figure 4), that are negative control (K_NEG), positive control for depression (KD_POS), positive control for aggression (KA_POS), depression groups (DP_1, 2, 3), and aggression groups (AP_1, 2, 3). This study was anticipated with an additional sample of 30%, but in the end, only four samples were included at best due to death that might be caused by acute stress.

Biological data

Biological data were taken from the brains of mice after all treatments were completed. Mice were knocked-out using chloroform and sacrificed. The surgical area should be disinfected with 70% alcohol and incised from the dorsal neck to the frontal bone following the midline suture of the cranium. The brain was extracted from the skull base and placed in a 10% normal formalin buffer for 24 hours. The brain was cut with 3-5 millimeter thickness on sagittal as far as 1/3 dorsal-anterior to obtain the cortex, parietal lobe, temporal lobe, and hippocampus—[13] Analysis of cells histopathology used hematoxylin-eosin (HE) staining including neurons and glia cells. Normal cells were counted on average in ten fields with an objective lens magnification of 40x. Normal cells are characterized by regular membranes, clear cytoplasm, a single observable cell, and a normal-sized nucleus.

Figure 3. Source of sound are put above the cage.

RESULTS

1. **Normality Test**
   This research found that the data distribution was uneven, so the statistical test was switched to a semi-quantitative non-parametric test.
2. **Mice model of depression**
   Mice were exposed to the tail suspension approach for 1 (one) hour and 7 (seven) days in a row to make a depression model and to provoke helplessness. The following table shows the difference between maze time and immobile time before and after the tail suspension approach.
3. **Mice model of aggression**
   A total of 16 mice were exposed to the tail suspension approach (day 0-7), which experienced psychomotor retardation and slight cognitive impairment (based on Table 3), continued with noise exposure (QRP 80-90 dB, day 8-14) to create aggression model. The following table contains the TM and TG of the aggression group.
   Table 5 shows a significant difference in the immobile time but not the maze time, as mice experience decreasing immobile time after noise exposure (mice were more active or agitated).
4. **Mice model of resilience**
   Both depression and aggression groups were given a QRP as treatment intervention (60 dB) but were not done simultaneously. The depression

Table 1. Normality test for initial TM and TG.

	Group	Sig*		Group	Sig*
Initial TM (TM0) $n = 36$	K_NEG	0.183	Initial TG (TG0) $n = 36$	K_NEG	0857
	KD_POS	0.951		KD_POS	0.086
	DP1	0.501		DP1	0.538
	DP2	0810		DP2	0.408
	DP3	0.630		DP3	0.406
	KA_POS	0.057		KA_POS	0.900
	AP1	0.635		AP1	0.972
	AP2	0.143		AP2	0.024 *
	AP3	0877		AP3	0.003 *

* Shapiro-Wilk test, significant if $p < 0.05$

group received QRP on days 8-14 after the tail suspension approach, and the aggression group received QRP on days 15-21 after noise exposure, as shown in the research flow (Figure 4). The analysis of pre-post intervention was performed in each group.

The QRP was differentiated into several doses: an hour once a day, an hour twice a day, and two hours twice a day, as shown in the following table.

Table 7 shows there was no significant difference between the QRP doses. The QRP intervention created a model of resilience in mice, but there was no difference between maze time and immobile time between doses, although it was previously mentioned that QRP was influential for the depression group (Table 6).

5. **Biological model of resilience**

The biological model of this study uses neurons and glial cells. The following compares the average number of neurons and glial cells between QRP dose groups.

DISCUSSION

Table 3 shows a significant difference in immobile time but not maze time—the mean rank of maze time increases but is not statistically significant (p>0.05). Acute stress, which occurs in less than 14 days, was not enough to disturb the spatial memory of mice, although the mean rank shows that mice were slower to find food. The mean rank of immobile time increased significantly (p<0.05) as mice were more immobile after the tail suspension approach (mice experience psychomotor retardation). This acute stress exposure created depression models with major psychomotor retardation but slight cognitive impairment. Table 3 shows that the tail suspension approach can create a depression model as the basis for aggression and resilience. As previous research showed, this method is a valid model for depressed mice.[14]

Table 4 shows a significant difference in the immobile time but not the maze time, as mice experience decreasing immobile time after noise exposure (mice were more active or agitated). Noise exposure did not interfere significantly with the spatial memory of mice, although the mean

Table 2. Mean and standard deviation of maze time and immobile time (in second). Groups were referred from the research flow.

	Mean ± SD			
	TM0	TM0N	TG0	TG0N
K_NEG	51.25 ± 26.424	45.5 ± 11.619	9.25 ± 5.315	7.5 ± 2.38

	Mean ± SD					
	TM0	TM_SUSP	TM_DQN	TG0	TG_SUSP	TG_DQN
KD_POS	39.25 ± 15.84	121.75 ± 57.927	80.75 ± 36.564	6.75 ± 1.893	7.75 ± 4.113	24 ± 32.094
DP1	25.75 ± 14.818	29.25 ± 16.879	34.75 ± 19.242	8.25 ± 3.096	25 ± 14.629	8.5 ± 4.041
DP2	37.75 ± 8.958	38.5 ± 20.306	78.25 ± 17.251	6.75 ± 3.862	19.75 ± 6.021	9.75 ± 6.652
DP3	61.5 ± 60.517	46 ± 21.833	62.75 ± 27.693	3.75 ± 1.258	17.75 ± 11.843	8.75 ± 6.994

	Mean ± SD						
	TM0	TM_SUSP	TM_NOISE	TM_AQN	TG0	TG_SUSP	TG_NOISE	TG_AQN
KA_POS	64 ± 83.018	38.25 ± 25.395	85.75 ± 33.807	84.25 ± 69.226	7.75 ± 3.304	10.75 ± 5.058	11.5 ± 15.022	16.25 ± 10.243
AP1	50.75 ± 35.957	40.75 ± 22.603	36.25 ± 13.72	68.5 ± 59.04	3.5 ± 1.291	17.25 ± 15.65	27 ± 26.994	8.25 ± 8.261
AP2	23.5 ± 20.92	51.25 ± 12.764	55.25 ± 46.55	60 ± 35.581	3.5 ± 0.577	10 ± 6.683	36.25 ± 25.953	20.25 ± 14.056
AP3	46.75 ± 24.73	67.25 ± 29.466	127 ± 63.948	99.75 ± 56.358	15.25 ± 25.184	13.5 ± 11.328	9.25 ± 3.096	13.75 ± 9.777

K_NEG = negative control; KD_POS = control group for depression model; KA_POS = control group for aggression model; DP1, 2, 3 = depression group 1, 2, 3; AP1, 2, 3 = aggression group 1, 2, 3. TM0 = initial maze time. TM0N = end maze time for the control group. TM_SUSP = maze time after tail Suspension approach. TM_DQN = maze time of depression group after Quran recitation approach. TM_NOISE = maze time after noise exposure of Aggression group. TM_AQN = maze time of aggression group after Quran recitation intervention. TG0 = initial immobile time. TG0N = end immobile time Of the control group. TG_SUSP = immobile time after tail suspension approach. TG_NOISE = immobile time after noise exposure of the aggression group. TG_AQN = immobile time after Quran recitation intervention of aggression group. Time in second (s).

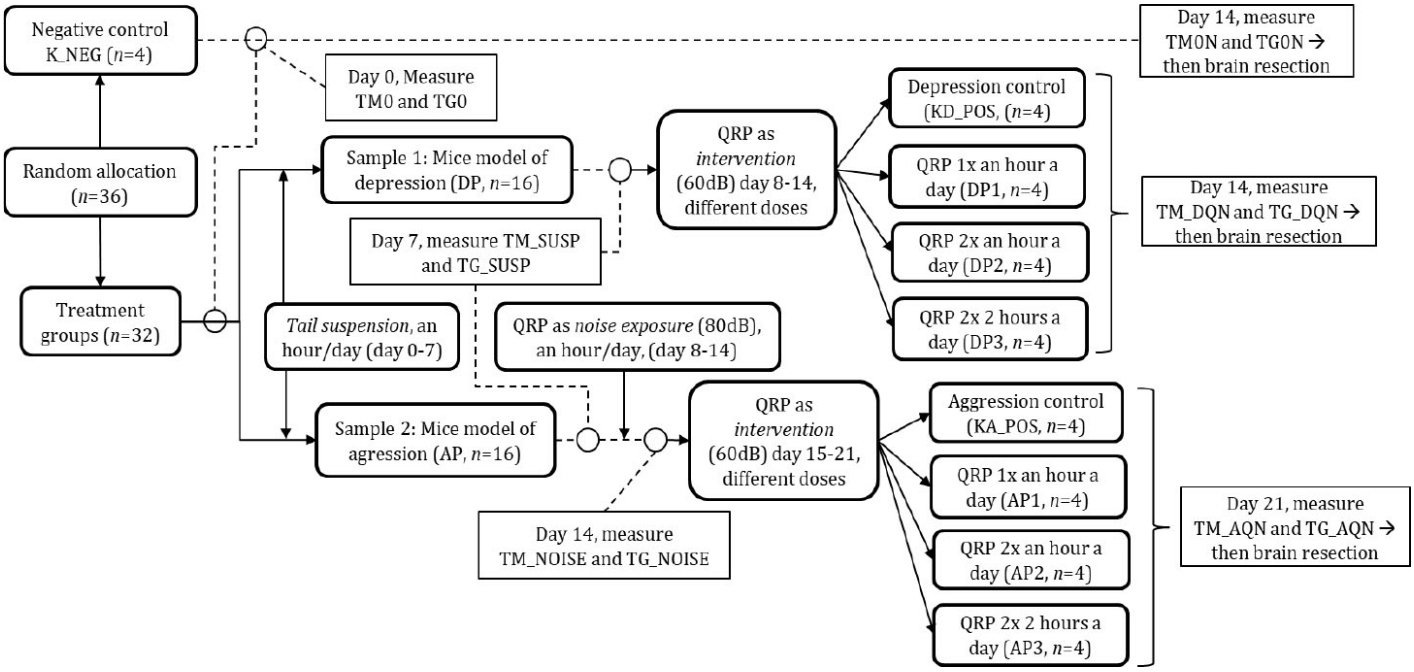

Figure 4. The research flow. K_NEG = negative control group. TM0, TG0 = initial maze time and immobile time. DP = depression group. AP = aggression group. TM_SUSP, TG_SUSP = maze time and immobile time after tail suspension approach. QRP = Quran recitation approach, 80 decibels (80 dB) and 60 decibels (60 dB). TM_NOISE, TG_NOISE = maze time and immobile time after noise exposure. KD_POS, KA_POS = control group for depression and aggression. DP1, 2, 3 = depression group for treatment dose 1, 2, 3. AP1, 2, 3 = aggression group for treatment dose 1, 2, 3. TM0N, TG0N = end maze time and immobile time for the negative control group. TM_DQN, TG_DQN = maze time and immobile time after intervention for the depression group. TM_AQN, TG_AQN = maze time and immobile time after intervention for the aggression group.

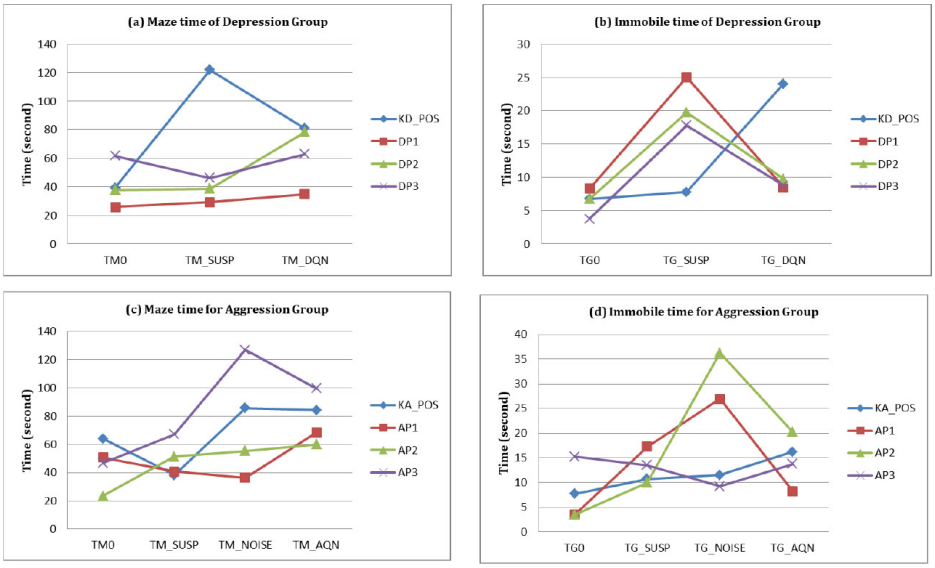

Figure 5. Average mean of maze time and immobile time of depression and aggression group. Immobile time was significantly decreased after the Quran recitation approach (b), but maze time was still slightly increased (a). There were no consistent changes in the aggression group (c and d).

rank shows an increasing time as mice experienced a longer time to find food. It is also assumed that mice experience cognitive impairment, as previous research mentioned.[15] Table 4 shows that these two exposures (tail suspension continued with noise exposure) created an aggression model as mice experience agitated behavior with slight cognitive impairment. Total days of exposure (tail suspension and noise exposure) reached 14 days should be enough to create a chronic stress model of mice[16], but it was not. Different yet consistent exposures in seven days may be perceived as predictable acute stressors and promote the cognitive adaptation of mice. Thus, there were no significant differences in the spatial memory of mice in pre-post 14 days of exposure.

Table 6 shows that there is no significant difference in maze time in each group which maze time after intervention in the depression group was higher than before (spatial memory increased), and in the aggression, the group was lower than before (spatial memory was decreased). The QRP seemed not consistent enough to promote a change in spatial memory of mice, but it would be a different interpretation if combined with immobile time results. There are a significant decrease in immobile time in the depression

group and an increase in the aggression group. It was described that the QRP intervention alleviated the psychomotor retardation in the depression group and calmed agitation in the aggression group. Thus the resilience model in mice was created. It could be assumed that QRP intervention may prevent aggression by treating depression before it worsens. Even though the statistic was insignificant, the aggression group showed a decrease in maze time and an increase in immobile time, meaning that mice were faster to find food but calmer than before. It may be concluded that QRP was able to promote goal-directed behavioral activation of aggressive individuals.

Table 7 shows there was no significant difference between the QRP doses. It also showed no difference between maze time and immobile time between doses, although it was previously mentioned that QRP was influential for the depression group (Table 6). This finding aligns with previous research that mentioned that a music melody could accelerate learning and memory performance in rats with no specific doses and time.[17]

Table 8 shows that the neuron cells group had at least one significant difference among groups, but not the glial cells group. Previous research mentioned that loud music could reduce neuron and glial cells due to excessive oxidative stress resulting from the vibration of the frequency and the subjective matter of loud music. This phenomenon was called "ototoxicity," while loud music became a thread for an individual.[18] Otherwise, soft music was considered a treatment option for anxiety due to the low frequency, less beat, and subjectively harmonic.[19] The comparison analysis of neuron cells was followed by a post hoc test to determine which group is significantly different, as shown in the table below.

Figure 6 shows the neuron and glial cells in the hippocampal cleft. As mentioned by previous research, the hippocampal mechanism is a basic of spatial memory learning impairment.[21] Even though the noise exposure has disappeared, the effect of decreased hippocampal neurogenesis has remained. Glia cells were assumed to play a key role in managing neuroplasticity-induced QRP intervention, but Table 7 shows the decreased number of glia cells, as shown in Figure 6. The optimum dose of QRP is an hour once a day, as mentioned in Table 8, as the average amount of neuron cells was higher than in other treatment groups. This finding needs further research to confirm whether QRP could induce neuroplasticity to treat depression biologically.

Table 8 shows that only QRP an hour once a day (QRPD1) is different from QRP two hours twice a day (QRPD3) in the depression group (QRPD). Based on the research flow (Figure 4), the difference in QRPD1 should be compared among

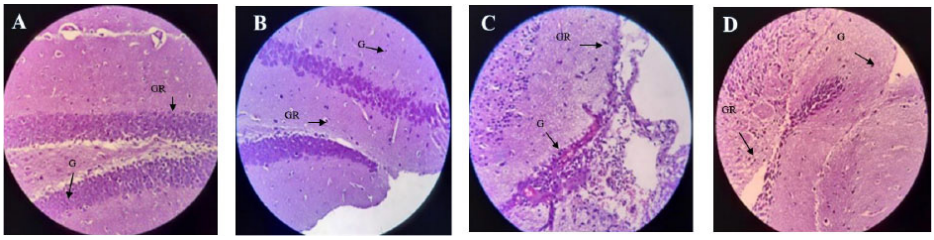

Figure 6. Microscopic appearance of glia cells in the hippocampal cleft of mice brain. G = Glia cells. GR = apoptotic or necrotic glial cells.A = KD_POS, control for depression group. B = QRPD1, depression group one receives Quran recitation an hour once daily. C = QRPD2, depression group two receives Quran recitation an hour twice daily. D = QRPD3, depression group three receives Quran recitation two hours twice a day.

Table 3. Maze time and immobile time of depression group.

	n	Mean Rank	Sig*	Comments **
TM0	32	1.44	0.493	There is no difference in the time of the maze. Mean rank increased after exposure (longer to find food).
TM_SUSP	32	1.56		
TG0	32	1.22	0.001 *	There is a significant difference in immobile time. Mean rank increases after exposure (more immobile).
TG_SUSP	32	1.78		

* Friedman test, significant if p <0.05. ** Comments based on the Friedman test.
TM0 = maze time before tail suspension approach. TM_SUSP = maze time after the tail suspension approach. TG0 = immobile time before tail suspension approach. TG_SUSP = immobile time after tail suspension approach.

Table 4. Maze time and immobile time of aggression group.

	n	Mean Rank	Sig*	Comment**
TM0	16	1.66	0.172	There is no significant difference between groups, and mice are much longer to find food.
TM_SUSP	16	2.03		
TM_NOISE	16	2.31		
TG0	16	1.44	0.001 *	There is a significant difference in the immobile time. Mice are more active after noise exposure.
TG_SUSP	16	2.31		
TG_NOISE	16	2.25		

* Friedman test, significant if p <0.05. ** Comments based on the Friedman test.
TM0= maze time before tail suspension approach. TM_SUSP = maze time after the tail suspension approach. TM_NOISE= maze time after noise exposure. TG0 = immobile time before tail suspension approach. TG_SUSP= immobile time after tail suspension approach. TG_NOISE= immobile time after noise exposure.

the depression groups but not with the aggression group (KA_POS, QRPA1, 2, 3), even though it was statistically different ($p<0.05$). Table 8 shows that the mean rank of QRPD1 was higher than QRPD2 and QRPD3, which might be assumed that an hour QRP once a day is good enough for depression, while a higher dose might be considered stressful and less useful as a treatment. It might be concluded that an hour of QRP once a day is adequate as a proposed intervention for depression. The number of neuron cells can be considered a model of resilience in this study, possibly related to the activity of brain-derived neurotropic factor (BDNF), which plays a role in the process of brain plasticity during acute stress.[20]

Table 5. The pre-post comparison analysis of maze time and immobile time in each group of depression and aggression after the intervention.

Depression Group	*n*	Mean Rank	Sig*	Comment**
TM0	16	1.44	0.617	No significant difference in the maze time, although the mean rank after therapy was still higher (mice were slower to find food)
TM_DQN	16	1.56		
TG0	16	1.91	0.001 *	A significant difference in the immobile time, the mean rank after therapy was lower (mice were more active)
TG_DQN	16	1.09		
Aggression Group	*n*	Mean Rank	Sig *	Comment**
TM0	16	1.56	0.617	No significant difference in the maze time, with a mean rank after the intervention being lower (mice were faster to find food)
TM_AQN	16	1.44		
TG0	16	1.44	0.617	No significant difference in the immobile time, with the mean rank after the intervention being high (mice were less active)
TG_AQN	16	1.56		

* Friedman test, significant if $p<0.05$. ** Comments based on the Friedman test.
TM0 and TG0 = maze time and immobile time before intervention. TM_DQN and TG_DQN = maze time and immobile time after the intervention of the depression group. TM_AQN and TG_AQN = maze time and immobile time after the intervention of the aggression group.

Table 6. The comparison of doses variation in each group.

Groups	Doses	*n*	Mean Rank	Sig*	Groups	Doses	*n*	Mean Rank	Sig*
TM_DQN	Control	4	11	0.112	TM_AQN	Control	4	8.75	0.618
	QRP1	4	3.75			QRP1	4	7.25	
	QRP2	4	10.75			QRP2	4	7	
	QRP3	4	8.5			QRP3	4	11	
	Total	16				Total	16		
TG_DQN	Control	4	9.88	0.893	TG_AQN	Control	4	9.62	0.532
	QRP1	4	8.5			QRP1	4	5.75	
	QRP2	4	8.38			QRP2	4	10.38	
	QRP3	4	7.25			QRP3	4	8.25	
	Total	16				Total	16		

*Kruskal-Wallis test, significant if $p<0.05$. TM_DQN, TG_DQN = maze time and immobile time after intervention in the depression group. TM_AQN, TG_AQN = maze time and immobile time after intervention in the aggression group. QRP1 = QRP dose an hour once a day. QRP2 = QRP dose an hour twice a day. QRP3 = QRP dose two hours twice a day.

Table 7. The comparison of neuron and glia cells among groups.

Neuron cells				Glia cells			
Group	N	Mean Rank	Sig*	Group	N	Mean Rank	Sig*
K_NEG	4	30.25	0.028*	K_NEG	4	28.88	0.187
KD_POS	4	19.12		KD_POS	4	26.75	
QRPD1	4	29.38		QRPD1	4	12.75	
QRPD2	4	20.38		QRPD2	4	16.5	
QRPD3	4	12.25		QRPD3	4	12.75	
KA_POS	4	11.38		KA_POS	4	18.88	
QRPA1	4	19.12		QRPA1	4	20.25	
QRPA2	4	7.75		QRPA2	4	11.62	
QRPA3	4	16.88		QRPA3	4	18.12	
Total	36			Total	36		

*Kruskal-Wallis test, significant if $p<0.05$. K_NEG = negative control. KD_POS, KA_POS = control group for depression and aggression. QRPD, QRPA = Quran recitation approach for depression and aggression group. QRP1 = QRP dose an hour once a day. QRP2 = QRP dose an hour twice a day. QRP3 = QRP dose two hours twice a day.

Table 8. **Post hoc analysis for average neuron cells among groups.**

Sig*	K_NEG	KD_POS	QRPD1	QRPD2	QRPD3	KA_POS	QRPA1	QRPA2	QRPA3
K_NEG	1	.	.	.	.	.	.	.	.
KD_POS	0.149	1	.	.	.	.	.	.	.
QRPD1	0.384	0.245	1	.	.	.	.	.	.
QRPD2	0.139	1.000	0.186	1	.	.	.	.	.
QRPD3	0.028*	0.384	**0.019***	0.129	1	.	.	.	.
KA_POS	0.029*	0.381	0.020*	0.139	0.769	1		.	.
QRPA1	0.110	0.885	0.038*	1.000	0.306	0.243	1	.	.
QRPA2	0.028*	0.146	0.019*	0.074	0.237	0.378	0.108	1	.
QRPA3	0.076	0.772	0.037*	0.758	0.372	0.375	0.655	0.225	1

*Mann-Whitney test as post hoc analysis, significant if p<0.05. K_NEG = negative control. KD_POS, KA_POS = control group for depression and aggression. QRPD, QRPA = Quran recitation Approach for depression and aggression group. QRP1 = QRP dose an hour once a day. QRP2 = QRP dose An hour twice a day. QRP3 = QRP dose two hours twice a day.

CONCLUSION

The depression model and aggression model, as well as the resilience model in mice, have been created. The QRP intervention can improve depression and aggression, but also a source of noise-induced stress on a higher frequency. These findings could be the basic explanation that the QRP as the source of resilience could also be a source of depression and aggression due to the frequency it is played. These results should be carefully generalized and need further research.

DISCLOSURE

Author Contribution

All authors have contributed to this research process, including conception and design, analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content, final approval of the article, and collection and assembly of data.

Funding

Authors (HA and TWB) received funding from *Lembaga Penelitian dan Pengabdian Masyarakat Universitas Nahdlatul Ulama Surabaya* (LPPM UNUSA) 2020.

Conflict of Interest

There is no conflict of interest in this manuscript.

Ethical Consideration

This research was approved by the Health Research Ethics Committee (*Komite Etik Penelitian Kesehatan*, KEPK) of the Universitas Hang Tuah Surabaya No. E/062/UHT.KEPK.03/VII/2019.

ACKNOWLEDGMENT

Authors sincerely thank Lembaga Penelitian dan Pengabdian Masyarakat Universitas Nahdlatul Ulama Surabaya (LPPM UNUSA) as the main institution in conducting research and financial support, Universitas Hang Tuah Surabaya (UHT) for the opportunity to conduct ethical laboratory treatment, as well as the Center for the Study of Religion, Radicalism, and Antiterrorism (*Pusat Studi Agama, Radikalisme, dan Antiterorisme*, PUSARA) as an independent institution in the study of depression and aggression.

REFERENCES

1. Nayef EG, Wahab MNA. The Effect of Recitation Quran on the Human Emotions. Int J Acad Res Bus Soc Sci. 2018;8(2).
2. Zarea Gavgani V, Ghojazadeh M, Sadeghi-Ghyassi F, Khodapanah T. Effects of listening to Quran recitation on anxiety reduction in elective surgeries: A systematic review and meta-analysis. Arch Psychol Relig. 2022;008467242211021.
3. Ghiasi A, Keramat A. The effect of listening to holy quran recitation on anxiety: A systematic review. Iran J Nurs Midwifery Res. 2018;23(6):411–20.
4. Mehrafsar A, Mokhtari MJ. Effect of Exposure to Quran Recitation on Cell Viability, Cell Migration, and BCL2L12 Gene Expression of Human Prostate Adenocarcinoma Cell Line in Culture. Heal Spiritual Med Ethics. 2018;5(4):46–52.
5. Vaghefi M, Nasrabadi A, Hashemi Golpayegani S, Mohammadi M, Gharibzadeh S. Nonlinear analysis of electroencephalogram signals while listening to the holy Quran. J Med Signals Sens. 2019;9(2):100–10.
6. Jasim MH, Salih MM, Abdulwahhab ZT, Shouwandy ML, Ahmed MA, ALsalem MA, et al. Emotion Detection among Muslims and Non- Muslims While Listening to Quran Recitation Using EEG. Int J Acad Res Bus Soc Sci. 2019;9(14).
7. Timora A, Setyopranoto I, Satiti S. PENGARUH MUROTTAL AL-QURAN TERHADAP KADAR SEROTONIN PLASMA DAN LUARAN KLINIS STROKE ISKEMIK AKUT. Universitas Gadjah Mada; 2020.
8. Algristian H. Kontra-Terorisme: Seandainya Dunia Tanpa Islam. Duta Masyarakat. 2018;
9. Rusnalasari ZD, Algristian H, Alfath TP, Arumsari AD, Inayati I. Students Vulnerability and Literacy Analysis Terrorism Ideology Prevention. J Phys Conf Ser. 2018;1028(1):012089.
10. Richter SH, Zeuch B, Lankisch K, Gass P, Durstewitz D, Vollmayr B. Where Have I Been? Where Should I Go? Spatial Working Memory on a Radial Arm Maze in a Rat Model of Depression. PLoS One. 2013;8(4):e62458.
11. Baribault H. Mouse Models for Drug Discovery. Methods Mol Biol. 2010;602(January):135–55.
12. Cryan JF, Mombereau C. In search of a depressed mouse: Utility of models for studying depression-related behavior in genetically modified mice. Mol Psychiatry. 2004;9(4):326–57.
13. Taliaz D, Stall N, Dar DE, Zangen A. Knockdown of brain-derived neurotrophic factor in specific brain sites precipitates behaviors associated with depression and reduces neurogenesis. Mol Psychiatry. 2010;15(1):80–92.
14. Stukalin Y, Lan A, Einat H. Revisiting the validity of the mouse tail suspension test: Systematic review and meta-analysis of the effects of prototypic antidepressants. Neurosci Biobehav Rev. 2020;112:39–47.
15. Jafari Z, Kolb BE, Mohajerani MH. Chronic traffic noise stress accelerates brain impairment and cognitive decline in mice. Exp Neurol. 2018;308:1–12.
16. Qiao Y, Zhao J, Li C, Zhang M, Wei L, Zhang X, et al. Effect of combined chronic predictable

and unpredictable stress on depression-like symptoms in mice. Ann Transl Med. 2020;8(15):942–942.
17. Korsós G, Horváth K, Lukács A, Vezér T, Glávits R, Fodor K, et al. Effects of accelerated human music on learning and memory performance of rats. Appl Anim Behav Sci. 2018;202(2000):94–9.
18. Sanyal T, Palanisamy P, Nag TC, Roy TS, Wadhwa S. Effect of prenatal loud music and noise on total number of neurons and glia, neuronal nuclear area and volume of chick brainstem auditory nuclei, field L and hippocampus: A stereological investigation. Int J Dev Neurosci. 2013;31(4):234–44.
19. Chaudhuri S. the Effects of Music on Stress. Int J Adv Res. 2021;9(02):524–38.
20. Azizah AS N, Veterini L, Algristian H, Salim HM. Expression of Brain-Derived Neurotrophic Factor in the Brain of Depressed Mice: Systematic Literature Review. Qanun Med - Med J Fac Med Muhammadiyah Surabaya. 2021;5(2):189–203.
21. Liu L, Xuan C, Shen P, He T, Chang Y, Shi L, et al. Hippocampal mechanisms underlying impairment in spatial learning long after establishment of noise-induced hearing loss in CBA mice. Front Syst Neurosci. 2018;12:35.