



Effects of music stimulus on behavior response, cortisol level and immunity horizontal of growing pigs

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Abstract

Enrichment environment is widely used to improve the welfare of domestic animals and satisfy their natural behavior. Music as an enriched environment can reduce abnormal behavior in humans, non-human primates and rodents. The aim of this study was to investigate the effects of repeated music stimuli on the behavior, physiology and immunity of growing pigs.

Results

1. The results of music and noise on the behavior of growing pigs

	Music	Noise	Control	F _{2,21}	P values
State behavior (%)					
Lying	80.83 ^a ±0.76	82.21 ^b ±0.37	85.18 ^a ±0.65	13.06	<0.001
Ventral lying	47.10±1.41	48.13±0.92	49.43±1.19	0.97	0.396
Lateral lying	33.74±1.29	34.08±0.96	35.87±1.09	0.23	0.799
Active	19.17 ^a ±0.76	17.79 ^a ±0.37	14.82 ^b ±0.65	13.06	<0.001
Standing	14.68 ^a ±0.56	13.81 ^a ±0.73	12.27 ^b ±0.56	6.52	0.006
Walking	4.49 ^a ±0.24	3.42 ^b ±0.20	2.55 ^b ±0.16	23.45	<0.001
Event behavior (n)					
Tail wagging	111.38 ^a ±22.72	15.50 ^b ±2.82	33.13 ^b ±4.25	14.41	<0.001
Playing behavior	67.88 ^a ±4.63	36.25 ^b ±2.01	32.75 ^b ±1.81	39.07	<0.001
Manipulating behavior	64.75±7.00	62.75±2.20	70.50±5.25	0.25	0.784
Exploring behavior	467.63 ^a ±16.35	457.38 ^a ±9.45	350.13 ^b ±11.06	26.54	<0.001
Aggressive behavior	25.88 ^a ±3.66	53.13 ^b ±1.99	26.25 ^b ±2.27	32.57	<0.001

The results of table 1 showed that lying behavior in the music and noise groups was significantly lower than the control group ($P < 0.001$), while their standing ($P < 0.05$) and walking behavior ($P < 0.05$) was significantly higher than the control group. The frequency of playing behavior, tail wagging in the music group was significantly higher than the noise and control groups ($P < 0.001$). The pigs in the music and noise group showed more exploring behaviors than the control group ($P < 0.001$). The aggressive behavior in the noise group was significantly higher than the control and music group ($P < 0.001$).

2. The results of music and noise on cortisol levels in growing pigs

Treatment	Day				
	D4	D28	D60		
Serum cortisol (ng/L)	Music	34.60 ^a ±1.73	34.52 ^a ±1.73	37.22±1.73	
	Noise	44.04 ^b ±1.73	35.47 ^b ±1.73	37.03 ^b ±1.73	
	Control	43.95 ^{ab} ±1.73	42.68 ^{ab} ±1.73	35.62 ^a ±1.73	
P _{treatment} =0.001, F _{2,24} =8.13; P _{day} =0.008, F _{2,24} =5.61; P _{treatment×day} =0.001, F _{2,24} =5.61					
Salivary cortisol (ng/L)	D8			D29	D57
	Music	39.05 ^{ab} ±0.27	31.43 ^a ±2.56	26.63 ^a ±1.01	
	Noise	45.01 ^a ±0.77	33.94 ^a ±1.83	25.50 ^a ±1.42	
Control	46.36 ^a ±2.07	36.53 ^a ±0.65	27.56 ^a ±0.88		
P _{treatment} =0.003, F _{2,24} =7.04; P _{day} <0.001, F _{2,24} =101.80; P _{treatment×day} =0.149, F _{2,24} =1.85					

The results of table 2 showed that Short-term (4d and 8d) music stimulus had a lower cortisol level than the noise and control groups ($P < 0.05$).

3. The results of music and noise on immune indexes of growing pigs

Treatment	Day			
	D4	D28	D60	
IL-2 (ng/L)	Music	156.40 ^a ±2.15	170.28 ^{ab} ±2.15	186.82 ^{ab} ±1.75
	Noise	158.42±2.15	155.36 ^a ±2.15	163.60±1.75
	Control	159.39 ^a ±2.15	159.99 ^{ab} ±2.15	169.29 ^{ab} ±1.75
P _{treatment} <0.001, F _{2,24} =27.73; P _{day} <0.001, F _{2,24} =51.38; P _{treatment×day} <0.001, F _{2,24} =11.77				
IL-4 (ng/L)	Music	33.96 ^a ±1.43	31.75 ^{ab} ±1.43	25.11 ^b ±1.17
	Noise	35.52±1.43	34.63 ^a ±1.43	33.12 ^a ±1.17
	Control	32.11±1.43	30.43 ^b ±1.43	31.65 ^a ±1.17
P _{treatment} =0.002, F _{2,24} =7.63; P _{day} =0.003, F _{2,24} =7.01; P _{treatment×day} =0.013, F _{2,24} =3.74				
IFN-γ (ng/L)	Music	92.81 ^a ±2.05	96.03 ^{ab} ±2.43	103.98 ^{ab} ±1.80
	Noise	88.78±2.92	89.04 ^a ±2.33	88.08 ^a ±2.39
	Control	87.76±1.28	85.87 ^b ±1.27	86.78 ^a ±1.43
P _{treatment} <0.001, F _{2,24} =3.74; P _{day} =0.180, F _{2,24} =1.81; P _{treatment×day} =0.065, F _{2,24} =2.46				
IgG (ug/mL)	Music	502.77 ^{ab} ±7.89	472.15 ^b ±7.89	567.32 ^a ±6.44
	Noise	574.41 ^a ±7.89	511.43 ^{ab} ±7.89	545.46 ^{ab} ±6.44
	Control	501.01 ^b ±7.89	479.08 ^{ab} ±7.89	528.02 ^{ab} ±6.44
P _{treatment} <0.001, F _{2,24} =2.10; P _{day} <0.001, F _{2,24} =41.59; P _{treatment×day} <0.001, F _{2,24} =11.40				

The results of table 3 showed that long-term (60d) music stimulus increased the level of IgG, IL-2 and IFN-γ ($P < 0.05$) and decreased the IL-4 level ($P < 0.05$). Long-term noise stimulus significantly reduced the level of IgG ($P < 0.05$), but did not affect the level of IL-2, IL-4 and IFN-γ ($P > 0.05$).

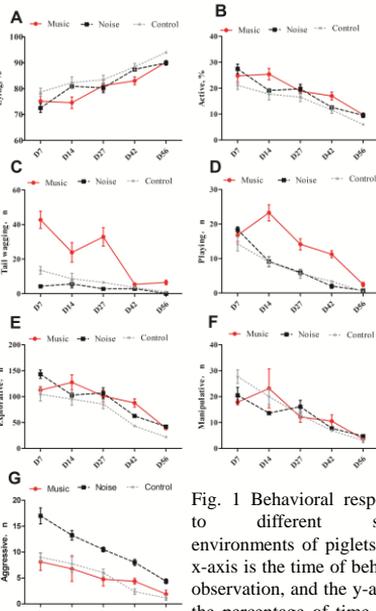


Fig. 1 Behavioral responses to different sound environments of piglets. The x-axis is the time of behavior observation, and the y-axis is the percentage of time spent on behavior or the frequency of the behavior

Conclusion

Music stimulus triggers the pigs to show more positive behaviors, the music environment increases the activity, tail wagging and playing behavior of the growing pigs, but long-term music stimuli reduce most of the observed behaviors and animals show habituation. And the short-term music stimulus can reduce the stress response, while the long-term music stimulus can enhance the immune responses in the growing pigs.

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