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The Influence of Stimulating The Neural Response on Physiological Response in Chicks

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Abstract: The neural response in the chick is beginning during the development of nerves and formation of the brain. At this stage, the chick begins to discriminate and recognize the external stimuli, as sound, light, and heat...etc. In nature, the hen incubates eggs and released the sound for hearing to chicks inside the egg. The chick will gain comfort and safety for the hen's feeling beside it. But in the artificial hatchery, there isn't this technical. So, the hatcheries were provided with different sounds as external stimuli and studied the neural response and physiological response. This study was carried out in University of Anbar, College of Agriculture, Animal Production Dept. by using 240 fertilized egg (Ross 308), distributed to four treatments,T1= first treatment control treatment without hearing any sound, T2= second treatment hearing the hen call , T3= treatment third hearing chicks hatched call and T4= treatment fourth hearing chick with hen call, each treatment divided into three replicates and each repeater 20 eggs, hearing the sound from the age of 5 days form incubation and until the day of hatching, the sound was given for a period of 15 minutes per hour in 24 hours, with usually (100-200 Hz) sound density of 65 dB. the results showing: significantly ($P \leq 0.01$) improvement in neural response (motility of nerves) and improvement in physiological response (brain development, weight brain, and increasing growth hormone and prolactin hormone)

Keywords: Stimulating, Neural Response, Physiological Response, Chicks

Introduction

Neurons are remarkable among the cells of the body in their ability to propagate signals rapidly over large distances. They do this by generating characteristic electrical pulses called action potentials: voltage spikes that can travel down nerve fibers. Sensory neurons change their activities by firing sequences of action potentials in various temporal patterns, with the presence of external sensory stimuli, such as light, sound, taste, smell and touch, it is known that information about the stimulus is encoded in this pattern of action potentials and transmitted into and around the brain (Hromádka et al., 2008). Although action potentials can vary somewhat in duration, amplitude and shape, they are typically treated as identical stereotyped events in neural coding studies. If the brief duration of an action potential (about 1ms) is ignored (Butts et al., 2007). An action potential sequence, or spike train, can be characterized simply by a series of all-or-none point events in time (Andrew, 2003) The lengths of interspike intervals (ISIs) between two successive spikes in a spike train often vary, apparently randomly (Stein et al., 2005). The study of neural coding involves measuring and characterizing how stimulus attributes, such as light or sound intensity, or motor actions, such as the direction of an arm movement, are represented by neuron action potentials or spikes. In order to describe and analyze neuronal firing, statistical methods and methods of probability theory and stochastic point processes have been widely applied (Chen et al.,

2009). With the development of large-scale neural recording and decoding technologies, researchers have begun to crack the neural code and have already provided the first glimpse into the real-time neural code as memory is formed and recalled in the hippocampus, a brain region known to be central for memory formation, neuroscientists have initiated several large-scale brain decoding projects (Zhang et al., 2013).

Physiological chronicles from single units in the lower levels of the vertebrate sound-related framework (sound-related nerve what's more, cochlear core) for the most part display sharp recurrence selectivity. Such neurons react to sound improvements over a constrained recurrence go and have a solitary recurrence (generally called the trademark recurrence or characteristic frequency) at which they react at the most reduced sound level (mammals:: Evans 1975; bring down vertebrates: Popper and Fay 1980). The circulation of characteristic frequency found in the sound-related nerve of a specific animal groups predicts the recurrence run over which they can hear, further, the characteristic frequency of units with the most reduced in general edges regularly correspond with an unearthly band which is of clear conduct significance, such as the scope of frequencies utilized in vocal correspondence or then again introduction (Havenith et al., 2011). Roundabout confirmation proposes that the motility of the chick incipient organism is neurogenic from the begin, by neurogenic we imply that conduct results from neural releases which drive the muscles, rather than myogenic action which results from unconstrained strong withdrawals (Ripley and Provine, 1972). A job for the sensory system in embryonic motility is recommended by the discoveries that electrical incitement of the sensory system brings out development and that curare, a neuromuscular blocking specialist, immobilizes early fetuses. That embryonic conduct is neurogenic is shown facilitate by Alconero, who found that somites of 3-day chick fetuses explanted on the chorio-allantoic layer neglected to create unconstrained development with the exception of when innervated by going with spinal rope parts (Abdulateef, 2017).

The impacts of the focal synapses, especially dopamine, noradrenaline, serotonin, GABA, acetylcholine, and histamine, on prolactin discharge in birds have been the subject of various ongoing examinations (Halbreich et al., 2003). It is, for the most part, considered that the capacity of the synapses is to fortify (or restrain) the arrival of Prolactin discharge factor and prolactin hindering component into the hypophysial entrance flow, which would then be able to be transported to the pituitary prolactin-emitting cells. Furthermore, there is confirm that a few synapses may effectively affect prolactin discharge at the level of the pituitary organ itself. (Grabauskas et al., 2004). The objective of this study to determine the effect of stimulating the neural response as a represented of maternal care as sound on physiological response in chicks.

Materials and Methods

Animal Study

The study was carried out according to the protocol approved by the University of Anbar, Ethics-Committee, Iraq. Fertile eggs from Ross (308) strain broiler breeder hens were procured from a commercial farm to run the experiment**.**

Experimental study

This study was carried out in University of Anbar, College of Agriculture, Animal Production Dept. by using 240 fertilized egg (Ross 308), distributed to four treatments,T1= first treatment control treatment without hearing any sound, T2= second treatment hearing the hen call , T3= treatment third hearing chicks hatched call and T4= treatment fourth hearing chick with hen call, each treatment divided into three replicates and each repeater 20 eggs.

Hearing Sound

For hearing the chicks to sound it is hearing the sound from the age of 5 days form incubation and until the day of hatching, the sound was given for a period of 15 minutes per hour in 24 hours, with usually (100-200 Hz) sound density of 65 dB.

Studied Traits

The Neuronal Response

The motility of nerves was measured using simulation and observation by the window of hatching, motility was measured in 1 Sec., as in Figure 1. according to Abdulateef (2017).

Physiological Response

Brain Development, Weight Brain

Chicks were killed (Euthanasia). They were decapitated and the brain along with the brainstem was removed from the skull by severing all the cranial nerves and vessels at the base. The whole brain was weighed.

Tissue processing Immediately after the tissue was obtained, it was immersion fixed in 4% of paraformaldehyde at 4°C for 2 weeks. The brains were dehydrated, infiltrated and the blocks were prepared by embedding in paraplast. Serial coronal sections of 7 µm thickness were cut with a rotary microtome. The sections were mounted on egg albumin-coated glass slides and subsequently stained for Nissl substance with 1% buffered thionin. A comparison of the size of sections of the brain of experimental and control groups at a distance of 2 mm from the rostral end of the brain was done (Kesar, 2014).

Measurement of growth hormone concentrations and prolactin hormone

Blood samples were taken at the age of 20 days of incubation. Blood samples were placed in the centrifuge type TRIUP 80-2 and at a speed of 6000 cycles/min for 5 minutes. After separating blood plasma, a special kit was used to measure the prolactin in poultry (from poultry) from MyBioSource, Using the ELISA BioTek ELX-50 ELISA 50 device, the method of operation is described in the manual attached to the kit according to (Chokchaloemwong et al., 2015, Abdulateef, 2016)

Statistical Analysis

This experiment were carried out by using Complete Randomized Design (C.R.D). and the Data were analyzed by using SAS program for statistical analyzing (SAS, 2001). The means for each treatments were compared by using Duncan's polynomial with 0.05 and 0.01 significance level to determine the significant differences between the averages **(**Duncan, 1955**).**

Results

Figure 1. Shown the effect of neural response on motility of nerves of chicks, there seen a significant increase ($p<0.01$) to T4 (19 motility / Sec. , compared with T1, T2 and T3 (11, 13 and 16 motility / Sec.) consecutively, while there was a significant increase ($p<0.01$) for T3 compared with T1, T2, and there is different between T2 and T1.

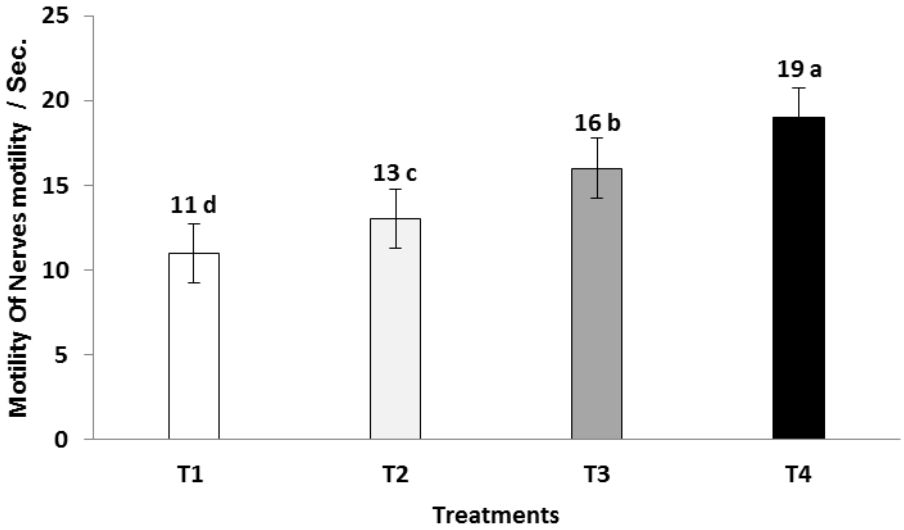

Figure 1. The effect of neural response on motility of nerves of chicks motility / Sec.

Table (1) shown the Effect of stimulating the neural response on neurophysiological traits in chick, there were significantly increase ($p<0.01$) in neurons for T2, T3 and T4 (41.41, 44.04 and 46.64 µm) consecutively, compared with D (301.23µm), while T4 had significantly higher ($p<0.01$) compared with T2 and T3, also T3 difference significantly ($p<0.01$) than T2. However, table (1) demonstrated the shown the effect of stimulating the neural response on neurophysiological traits in chick of brain weight, there was no difference between T3 and T4 (0.92 and 0.95 g.) consecutively, while there are a significant increase ($p<0.01$) between them and other treatments, but there are significantly different ($p<0.01$) compared with T2 and T1 (0.90 and 0.79 g.) consecutively.

Table 1. Effect of stimulating the neural response on neurophysiological traits in chick

Treatments	Neurons Micron (µm)	Brain weight gm.
T1	31.23 d	0.79 c
T2	41.41 c	0.90 b
T3	44.04 b	0.92 a
T4	46.64 a	0.95 a
Mean	40.92	0.89
***SEM**	1.78	0.01
Significant	0.01	0.01

* SEM: Standard Error Mean
** N.S.: Non Significant
a, b, c: means in the same Rows with different superscripts differ significantly.

Figure (2) shown the effect of neural response on concentration GH and PRL (Ng / ml), there seen a significant increase ($p<0.01$) to T4 in concentration of GH (57.45 Ng / ml) , compared with T1, T2 and T3 (36.32, 44.9 and 54.17 Ng / ml.) consecutively, while there was a significant between T2 and T3 compared with T1. Also there seen a significant increase ($p<0.01$) to T4 in concentration of PRL (56.24 Ng / ml) , compared with T1, T2 and T3 (36.44, 43.20 and 52.67 Ng / ml.) consecutively, while there was a significant between T2 and T3 compared with T1.

Discussion

The development of the brain and the sense of the bird's comfort and safety and calm when hearing sounds will work to produce opioids Opioid, which works to calm and reduce movement and direct the energy spent on the movement towards growth and build the body (Nelson, 2011). On the other hand, opioids act to stimulate feeding behavior in birds by stimulating Peptide YY, which helps to prolong the duration of nutrition and regulate the appetite of chicks and then develop the behavior of nutrition and this is what he said (Zendehdel and Hassanpour, 2014). The reason for the improvement in embryonic growth is that the presence of opiates in the body works to regulate structural hormones if the opiates act as a regulator of hormones in the body in particular

growth hormone and prolactin, as it works to create and activate the hormone receptors and increase the secretion through the gene expression to manufacture the hormone and improves the ability of pituitary cells to The hormone secretion is what he said (Limonta et, al., 1986).

In addition, exposure to sound will produce the cocaine-and amphetamine-regulated transcript (CART) secreted from the ventral tegmental area (VTA) of the brain. This hormone increases the secretion of prolactin (Baranowska et al., 2007) In addition to the presence of prolactin and growth hormone, ghrelin works with these hormones to increase the biological processes and thus lead to an increase in body weight. Fox (2005) mention which refers to the role of ghrelin in stimulating these hormones and interacts with them and thus improves vital processes in the body, this leads to increased body weight and this agreed with (Fox et al., 2015). The opioids help prolactin secretion by facilitating the work of some neurotransmitters in the brain competent to control prolactin secretion and modulate the activity of catecholaminergic, serotoninergic activity and Cholinergic Systems, which prevents liver deposition and facilitates movement in cells to increase vital processes (Edens and Parkhurst, 1994). There is a chemical similarity between prolactin and growth hormone, so there is a similarity in biological functions. Prolactin activates body growth and weight gain in birds, reptiles and mammals due to its similarity with growth hormone GH, because prolactin injection causes a significant increase in body weight (Goffin and Kelly, 1997). The reason for the superiority of the neural ganglia in the chicken brain is due to the role of sound stimulation in increasing the size and area of neural connections, increasing the differentiation of neurons, increasing the length and size of nuclei in neurons and glial glial nuclei, as well as increasing the length of Ganglion ganglion and increasing the expression of c-fos (Wadhwa et al., 1999) and agreed (Alladi et al., 2002 . Chaudhury et al., 2010). The sound stimulation of chicks prior to hatching helps improve the brain's higher functions, such as learning and memory. It also contributes to the development and formation of the Hippocampus, promotes sound stimulation of the neurogenesis process and modifies neural connectivity between cells and agrees with it (Chaudhury et al., 2013).

The question here is what is the cause of brain and neuronal development and rapid response to sound stimulation? Cochleovestibular ganglion is a sensitive nerve located between the abdominal wall of the ear and connected to the inner abdominal part of the back of the brain. Hindbrain is composed of nerves containing the hair cells of a complex In this sensory nerve patch, this nerve node works to receive the sound from the periphery and turn it into a sensory signal to the brain. It performs the mechanical sensor, which connects and connects the sensory patches in the ear with the brain. The development of this region, therefore, works to develop the brain by increasing the efficiency and activity of brain cells. This is what Battisti et al. (2014) noted that vocal stimulation works on the development of these nerve nodes and thus the development and growth of brain and brain cells (Sandell and et al., 2014). The sound stimulation, like the sound of parents, facilitates the movement of chicks, facilitates spatial orientation, and increases the ability to learn as a result of the physical, chemical and biological development of sound in the brain as it increases the development and activity of nerve nuclei. Thus, sound stimulation plays a role in brain growth and development, Neurons Synaptogenesis (Sanyal et al., 2013), this was agreed with Kumar and Wadhwa (2014), who pointed to the role of sound in the growth of hypothalamus and brain as increasing cell size and nucleus size and increasing the protein expression of the development of neural engagement and thus developing in some formality traits (Scanes, 2015).

Conclusion

In concluding that The neural response to external stimuli as sound will be improving in physiological response (brain development, weight brain, and increasing growth hormone and prolactin hormone), this let to developing of the embryo and help it to successful hatching.

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