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Biological Assessment of Blasting Noise and Vibration in Residential Area: I. Damage of Residents and Dogs

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As the results of investigation, the noise level was between 60 dB and 80 dB in the area of explosion. The residents living within 1 Km would feel uncomfortable. However, hearing loss is not happened by this range. The maximum range that the human can hear is 20,000 Hz and the maximum range that the dog can hear is between 20 Hz and 40,000 Hz. The auditory range for humans to be uncomfortable toward noise is between 1,000 Hz and 2,000 Hz.

As the result of this experiment, the auditory range of dog is more wide than of a human. The change of hair cells in the Corti's organ occurred when the dog was exposed to 1,000 Hz at 100 dB for 1 month. Therefore, the structure change of the ear could happen by hearing loss because of noise, but the structure change of hair cells is the worst symptom by hearing loss because of noise.

Key words : noise, vibration, hearing loss, uncomfortable level

1. Introduction

While it is processing that the government is cutting out the mountain, which is located at the back of resident area to fill up the area of J village in T city of Kyung-Nam Province, many disadvantages including vibration and noise of explosion give the residences suffering damages. People saw this case as bothering the resident area. This Government Business is processing from 1994 to 1996. The residences thought that the business developing area is destroying not only the ecosystem but also the environment of the mountain. This research deals with how much the damages of explosion noise affect the life of residences and with the suffering damages of residences who are living in this area. The three points are to measure the noise level of the environment and that of explosion around working place in residential area. The first point is 100 m away from a resident area, and the second point of the area is chosen to measure the noise from driving a car on the road. The third point which is a pet-breeding farm is 200 m away from the working place for measuring the level of noise. By estimating the effect of the environment in our research, we want to suggest a reduction plan which can help for residents not to have physical, mental, and economical disadvantages when they face a damage situation.

2. Subject of Assessment and Methods

J village of T city in Kyung-Nam Province was subjected in this assessment. Explosion time was usually between 12 pm and 1 am. The influence of humans and animals were investigated noise and vibration level. First of all, by the anatomical and physiological special characters of

dogs to know the influence of noise, and physiological change and serious damages of pregnant dog's body were examined. A dog is a mammals and is taxonomically animal included Vertebrata, Mammalia, Carnivora, Canis. Wolf, Coyotes, Jackal are in the same categories, but the domestic dog is known as special species. The dog has been breeding from the past, and it is spread into all over the world. There are about over 400 species including a variety species. As the dog has been breed by humans from the 12000 years ago, it has been changed from nocturnal and carnivorous animal . to daytime omnivorous animal. Dogs became pets in the house. In general, dogs have been used in laboratories as experiments and have been used as hunting dogs, because they are not wild and prolific. The dogs which are used as pet in our nation are the Beagle, Yorkusherteria, Mallus, Formelion, Chiwawa, Fudle, Turg, Shieze, Syunaiser, Miniturepinset, Pekinise, and so on (Anderson, 1970; Gay, 1974).

2.1. Measurement of noise hearing loss

Audiometer, coincides with ISO which is an instrument that can measure the wavelength of sound. This audiometer(model GSI-10 and GSI-33) was tested in a closed room in an environmental research center in J village, which was a comparably quiet place, where hardly any noise of the surrounding environment could be heard. The order of measurement of the measured sound starts at 1000 Hz and then is measured at higher wavelengths. Then it starts again at 1000 Hz and is measured gradually at lower wave lengths. If the measurement of the first and second numbers are different by 5dB or less, there is a retest(Bekesy, 1960). The individual Puretone Threshold Determination Test, in the ascending method measuring sound according to the American Standard Association. For the sorting test, we used frequencies of 250, 500, 1000, 2000, and 4000 Hz(Watson, 1967). The constant level of sound pressure could be heard. Also, the air conduction that causes hearing loss measured at frequencies of 500, 1000. 2000, 4000, 8000 Hz. The sound frequency means the number of vibrations per second and the unit normally used is the Hertz. The domain of frequency that a person can hear is width and the average range is from 20 to 20,000 Hz (Abdala, 1995).

2.2. Light Microscopic Experiment

For the experiment of hearing loss, mice and dog were exposed to 100 dB for 6 hours per day during 1 month. The ears of the animals with exposure from noise were fixed in 10% neutral formalin for three hours. The tissues were embedded in paraffin (melting point 56-58 ℃) and cut by the longitudinal axis of the samples 6-8 μ in thickness. The sections were stained with Hematoxylin and Eosin. Slides were photographed with Kodak film under an Olympus BH-2 microscope (White, 1987).

3. Results

3.1. Measurement of Noise and Vibration Levels

As measured areas of explosion noise and vibration, the first point is residential place 100 m away from the working place, the second point is the side of road 60 m away from the working place, the third point is a pet-breeding farm 200 m away from the working place. The maximum level of explosion noise is 79.8 dB in Feb. 12 of 1996, 78.0 dB in Feb. 13, 70.2 dB in Feb. 14, 77.9

dB in Feb. 15, 68.0 dB in Feb. 28, 75.6 dB in Mar. 6, 83.8 dB in Mar. 13, 82.0 dB in Mar. 16, 70.7 dB in Apr. 2, 72.0 dB in Apr. 3, 81.0 dB in Apr. 12. Table 1 shows specific numbers which is measured explosion noise level and Table 2 shows maximum levels for blast vibration.

3.2. Measurement of Uncomfortable level

A threshold is the strength of minimum stimulus that expresses sense reaction from an outside stimulus of humans. The uncomfortable level is the minimum level that the human feels uncomfortable from noise in the body. The range of measurement was between 0 dB and 90 dB of noise level, and measured to increase the

Table 1. The measurement data of blast noise.

unit : dB(A)

M/D \ NM	1	2	3	4	5	6	7	8	9	10	11
2/12	62.0	64.0	79.8	60.5	63.3	76.6	63.7	72.0	69.4		
2/13	73.6	74.2	68.0	75.0	77.4	77.0	78.0				
2/14	64.0	65.0	61.9	55.5	70.2						
2/15	63.5	77.9	70.7	71.1	72.5						
2/28	60.0	68.0	59.0	57.0	56.8	66.1					
3/6	63.5	75.6	65.0	68.1	63.2						
3/13	66.4	57.0	73.0	68.2	70.9	70.9	67.2	83.8	76.5	72.8	71.5
3/16	61.0	82.0	78.5	80.6							
4/2	56.5	67.0	68.0	70.3	70.7						
4/3	72.0	69.5	68.5	67.1	70.5						
4/12	76.3	81.0	62.3								

* M/D - Month/Date ; NM - No. of Measurement

Table 2. The measurement data of blast vibration.

unit : dB(A)

M/D \ NM	1	2	3	4	5	6	7	8	9	10	11
2/12	81	83	80	80	78	81	80	85	78		
2/13	59	58	75	65	74	74	77				
2/14	61	64	64	71	70						
2/28	74	61	65	67	71	69					
3/6	80	88	78	76	74						
3/13	64	56	70	68	69	72	71	71	73	69	68
3/16	62	83	76	79							
4/2	64	68	70	63	63						
4/3	68	70	74	74	73						
4/12	75	84	63								

* M/D - Month/Date ; NM - No. of Measurement

frequency as 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz (Table 3). Although there is a difference depending on the individual, a maximum uncomfortable level is at the time when the sound causes a pain of the human ear and human starts to feel uncomfortable. After explaining to an individual about this situation, humans press a button when he feels uncomfortable. The uncomfortable level is measured for each a second with the controller (Hood, 1968).

3.3. Corti's organ

In general, the structural changes of long time-exposured ear by noise were found destroying the tympanic membrane, changing location of ossicle, and damage of Corti's organ(Edmund, 1974; David, 1987). In the exposured ear at 4000 Hz, the cells of Corti's organ were occurred damaged and then arranged in irregular(Fig. 1 and 2). Destroyed hair cells were observed, and other structural cells, such as Hesen's cells and phalangeal cells, were composed of irregular shapes(Fig. 2).

Table 3. The uncomfortable level of normal human by frequency.

Hz / arrested	250		500		1000		2000		4000	
	left	right	left	right	left	right	left	right	left	right
1	68.1	68.3	72.3	72.3	70.3	70.4	71.6	71.5	69.1	69.1
2	77.2	77.3	79.6	79.8	81.0	81.0	787.8	78.8	70.8	70.9
3	85.0	85.2	83.2	82.9	85.8	85.9	82.2	82.3	75.3	75.4
4	76.3	76.1	75.5	75.5	95.1	95.2	81.1	81.2	75.6	75.4
5	78.7	78.8	76.7	76.8	75.3	75.3	72.3	72.5	76.5	76.5
6	75.4	75.2	80.9	80.9	80.0	80.3	75.9	75.8	70.8	70.7
7	85.9	85.5	78.7	78.4	82.8	82.8	73.1	73.2	74.2	74.0
8	75.3	75.3	84.8	84.8	88.7	88.5	78.8	78.9	81.3	81.2
9	70.9	70.6	86.7	86.9	94.3	94.4	85.5	85.8	74.3	74.3
10	80.5	80.4	88.8	88.7	85.1	85.1	92.7	92.5	91.6	91.5
11	84.0	84.0	91.1	91.2	90.6	90.7	85.6	85.6	81.3	81.2
12	84.3	84.3	76.6	76.7	83.3	83.3	80.0	79.9	70.2	70.3
13	75.1	75.9	85.5	85.3	96.5	96.4	88.1	88.0	75.0	74.8
14	80.8	81.0	79.9	80.0	91.1	91.0	78.1	78.2	88.1	88.2
15	89.1	89.1	94.4	94.5	95.2	95.4	90.0	89.8	89.7	89.6
16	96.2	96.3	99.8	100.0	98.0	98.2	96.2	96.3	94.3	94.4
17	84.2	84.4	86.2	86.2	84.8	84.7	80.9	80.8	85.8	85.9
18	75.9	76.0	90.7	90.8	93.6	93.7	82.1	82.3	83.7	83.7
19	91.0	91.1	94.9	94.9	88.9	88.7	93.7	93.7	90.6	90.5
20	94.1	94.1	99.6	99.6	96.5	96.4	98.7	98.6	88.9	88.9
Sum	1628.0	1628.9	1705.9	1706.2	1756.9	1757.4	1665.4	1665.7	1607.1	1606.5
Average	81.43		85.30		87.86		83.28		80.34	

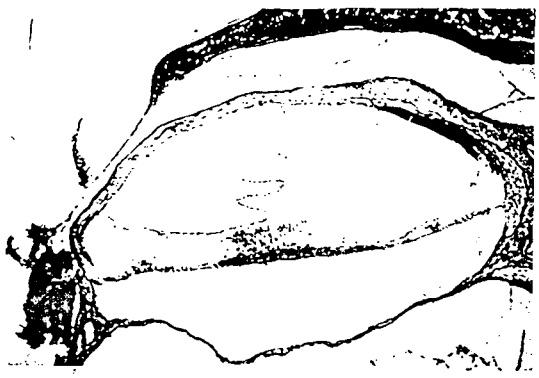

Fig. 1. Corti's organ and peripheral tissue of ear exposed to 6 hrs per day at 1000 Hz (at 100 dB) for 1 month.

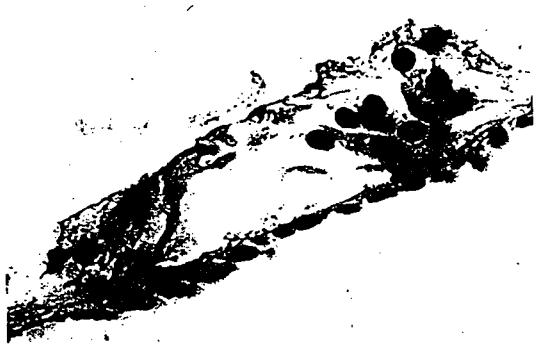

Fig. 2. The abnormal hair cells in the Corti's organ exposed to 6 hrs per day at 1,000 Hz (at 100 dB) for 1 month.

4. Discussion

4.1. Noise Hearing Loss

The ear can be divided into 3 parts; the outer ear, middle ear, and inner ear. The outer ear has the pinna, the external auditory opening, and the external auditory meatus. The pinna takes the role of gathering sounds. It is through the pinna that sounds are transferred to the external auditory meatus, and the external auditory meatus is a kind of resonator which amplifies the sound of 3 Hz of frequency and vibrates the tympanic membrane. The tympanic membrane has a round shape and has the width of 0.3-0.4 cm. The outer ear is on the outer boundary of the tympanic membrane and the middle ear borders the tympanic membrane's inside. The middle ear is divided into 2 parts: the tympanic cavity and the eustachian tube. The tympanic cavity contains the auditory ossicle, which has 3 bones; malleus, incus, and stapes. The eustachian tube connects the tympanic cavity with the neck. These 3 small bones increase the power of the sound being transferred from the tympanic membrane 10-20 times instead of lowering its amplitude. Sound is carried to the lymph in the inner ear by the fenestra vestibuli. However, the eustachian tube controls the pressure of the middle ear and helps the tympanic membrane to vibrate easily. In the case of high sound pressure, the muscle of the middle ear goes through the contracting process and limits the amplitude of sound (David, 1987). This acts within 10 m/s but has no effect in the case of explosive or shocking sounds. The air of the middle ear has the role of braking the vibrations of the tympanic membrane. The inner ear has a snail cavity or membranous labyrinth which is a very complex structure, and plays the role of a hearing sense and balance sense. Sound is transferred from 3 bones to liquid in snail cavity through the fenestra vestibuli. The Snail cavity consists of three semicircular canals, utriculus, sacculus and ductus cochlearis, and it has a tectorial membrane. This basal membrane has a neural cell which transmits the sense of sound to cerebrum. The size of sound is proportioned to the vibrating amplitude of basal

membrane. The amplitude of sound can be distinguished by transmitting location of basal membrane(Edmund, 1974).

Hearing loss is a disorder phenomenon tells people that is something wrong when sound is transferred. To understand transmitting trace of sound help us to know the process of hearing loss. The pinna of outer ear gathers sound and vibrates the tympanic membrane by passing the outer ear. After the vibration is transferred into malleus, incus and stapes, the power of sound is going into the inner ear after increasing 20 times of power of sound step by step. And sound is going into fenestra vestibuli. The chochlea of the inner ear has a hearing acceptor and vibration of sound vibrates liquid of sound wave. This excites the acceptor cell and stimulates hair cells. After this stimulus is transferred into the auditory nerve, it reaches the auditory central nerve of the cerebrum. So, if something is wrong with the transmitting process, it will be a hearing loss(Nelson, 1995).

Hearing loss can be divided into conductive hearing loss, sensor-neural hearing loss or mixed hearing loss. First, conductive hearing loss is a disorder that occurs between the outer ear and fenestra vestibuli. Therefore, when the tympanic membrane is bursting or the ossicle is not functional, sound cannot be reached into the hearing acceptor. So, conductive hearing loss occurs at this time. Second, sensor-neural hearing loss is a disorder that occurs between the hearing acceptor and hearing central nerve. Third, mixed hearing loss is a disorder that occurs both ways. If a sound is too loud, hearing disorder is undurable to the size of stimulus. The phenomenon of hearing disorder happens at a time. So, it will be recovered after about a day according with the degree of noise. Except the noise hearing loss that coming from damage of the inner ear, the hair cell in the Corti's organ was hurt by noisy sound of explosion. So, it falls off and hearing damage happens (Kapur, 1965).

Hearing loss caused by strong noise is Temporary Threshold Shift(TTS), Permanent Threshold Shift(PTS) and Preshycousis. Among them, the symptom of TTS is a temporary phenomenon of less hearing which happens after the hearing loud a sound. The term of TTS is comparably short and it will be recovered. This TTS is coming from strong noise, and the transmission of the auditory nerve is temporally decreasing. If somebody is working at the place that has a noise level between 85 dB to 95 dB for 8 hours per day, he will totally recover his hearing ability the next morning. And the PTS is called noise hearing loss that is unrecoverable for two or three days after hearing noise. And the hearing ability gets weak because of noise and is hard to recover. If exposed by intermittent noise is continued for long time, PTS will happen. PTS comes from destroying tympanic membrane caused by noise, damage of the last nerve in Corti's cavity or changing location of the ossicle. When exposed to noise, hearing disorder happens 3000-6000 Hz range of noise level and it occurs especially at 4000 Hz. Hearing damage spreads in the range over 6000 Hz and above 3000 Hz. Therefore, the important characteristic of noise hearing loss is hearing damage at about 4000 Hz range. If somebody has a hearing loss at 4000 Hz range, we understand he is occupationally exposed too much from the noise (Rosen, 1984). The other characteristic of noise hearing loss is that hearing ability proportionally gets weak when older. The complex elements including power of older noise, hours of noise and condition of individual are concerned to occur noise hearing loss. To hear loud sounds for a long time is dangerous. The damage of hearing ability generally comes out as a symptom of exposure at the noisy work place for at least 8-10 years. Especially, damage of

hearing ability starts from high frequency ranges which are between 3000 Hz and 6000 Hz. Both ears usually have the same symptoms. But, it is interesting that any sounds which are below 80 dB do not influenced doesn't cause hearing loss. It only shows discomfort of other people, mental pressure, and being startled. If 0 dB is the smallest level that the normal human can hear, hearing disorder can be measured by the change of hearing ability by instrument of hearing ability(Whitehead, 1995).

4.2. Response of human toward to noise

Nowadays, many civilians are being exposed from the noisy environment and people who are living in the urban and suburban are submitting the civil appeal. The noise level has been increasing two fold in our every year because of construction work developing society. Among many diseases of our body, it is known that 70% of mental disease is caused by noise. The symptoms caused by strong noise are lack of sleep, discomfort and uneasiness that can cause indigestion and nervous characteristics even it is dependent of each individual. These are caused by exceeded noise. If the noise level of over 100 dB is continued, it is recorded to cause high-blood pressure, dizziness and megalomania. The outbreaking rate of heart disease and mental disease are increasing, and it is a phenomenon that can occur at the exceeded noisy state (Zhang, 1992). The reaction by the characteristic of noise can have different results according to the person who is hearing noise in what kind of mental state, or what kind of environment. Among the frequency elements of noise, the higher frequency causes more influence. When the high frequency element is greater than the low frequency on and the increasing time causes more influence. But continuous and repetitive noise is causing more influence, and intermittent shocking sounds are causing more influence. The reaction that the human is able to feel can be changed according to the state of his health condition. A patient or pregnant woman rather than an healthy person, a woman rather than man, and young guy rather than old guy are more sensitive according to depending on their physical condition or mental state. When somebody is sleeping or taking a break rather than working, the size or influence of noise makes a big difference. And, the degree of sensitivity can be different according to environment. The person who is used to hearing noise often is not influenced by general high-noise but he also gets physical and mental uncomfort and a decreasing ability of hearing.

The influence of noise is giving less influence to people who are occupied in simple work, but people who are occupied in complex work are getting a higher influence. The ideological noisy environment should be less than 55 dB of noise level with opening a window in the classroom or office. And it has to be less than 40 dB in the living room or conference room. If it is about 60 dB of noise level, people will have a hard time understanding the conversation. In general, the noise level that starts to appeal to unpleasantness is 50 dB in resident area, 55-59 dB in industry areas, 50-54 dB in school, 45-49 dB in hospital, and 86-91 dB in airport areas. It is recorded that discomfort including mental unstableness or anger by noise can occur when the noise level is above degrees (Moll, 1976). The noise level that is not bothering sleeping is about 20-25 dB. When the noise level is 35 dB rather than 30 dB, it takes 20% more time to sleep, and takes 10% less time to wake up. Duing to the masking effect, the disturbance of conversation occurs (Abdala, 1995). The noise level of disturbance of conversation is 50-54 dB in school, 50-54 dB in radio or TV. And, noise level of disturbance of work causes

less working effect in 95 dB and less concentration in 90 dB. The disturbance of sleeping is a direct damage from noise level which is over 55 dB in the noon and over 40 dB in the night. The ideological noise level is 40 dB in the bedroom (Moll, 1976; Noren, 1987).

4.3. Response of dog toward to noise

In the genital characteristics of the dogs (McSheehy, 1976), a dog which is separated from its group felt uncomfortable in the new environment. That is, many functional changes in the body are caused by uncomfortable situations which is totally different environment. If a wild animal is controled by human, it will express unusual behavior and the bacteria that is living inside of the body of a wild animal will change. In this kind of state, although it is expected that various changes which are the physiological change, reduction of life, and disability of reproduction of dog will happen, there is no direct record of research. The defense reaction of experimental dogs which occurs inside of the body with increasing the noise level from 65 dB of the lowest noise level step by step from Feb. of 1996 to the present. The maximum range of hearing ability of humans is 20,000 Hz, but a dog and bat range is between 20 Hz and 40,000 Hz comparing with human. They are influenced by not only noise shock which is range between 40 dB and 50 dB in normal noise level, but also the phenomenon of hearing loss which humans can feel. In addition, there are various records about functions of blood pressure, heart rate, and enzyme activity of blood serum. If the stimulus of noise is continuous for a long time, the body temperature is normal without any change. It is trending after the number of breathing is increasing between 28/min and 48/min of the measured average rather than between 25/min and 45/min of normal average, it will be back to the normal state. It is easy for a dog to be effected by shocking environment that is like noise, but it is expected that it takes a long time for a dog to express unusual behavior. Therefore, the characteristics of a dog are closely related to its general living environment rather than a stimulus of outside noise. Also, if unexpected noise is over 130 dB, pigs, dogs, and cows will be able to be prematurely delivered of dog and have a miscarriage (Ames, 1974; James, 1974). For example, the continuous giving birth and the birth of dead chick등 are increasing in the chicken's case, and the rate of conception is decreasing in the pig's case, and the temporary, loss of appetite will happen to cows. If it is loud noise enough to be scared, the number of breathing and heart beating is changing (Okamoto, 1963; Zoldag, 1983).

4.4. Response toward to vibration

The physiological and mental change of humans can be different according to the degree of vibration. the damage degree of vibration that humans can feel is 1-90 Hz of low range in frequency. According to the vibration degree that measures earthquakes, 0 degree on the Richter scale is 55 dB, 1 degree is 60 dB, and usually 60-80 dB are often. And 4 degree which is the middle degree is 90-95 dB. A strong earthquake on the Richter scale is 100-105 dB, and it can cause wall-falling in the house. Depending on the human, there is a difference in feeling the vibration. For example, the vibration of dump or huge truck and an excavator in a construction place is relatively close to a house area. Even though the vibration degree is greater than a plant's vibration, the number of appeal in construction place closed to house area is much less than plants' one because the expectation that

people think construction is temporary and it will be over soon makes reduced feeling degree. For another example, although the vibration level when a person is driving is 70-80 dB which is relatively high, the number of appeal is almost zero because people think cars are always vibrating. But, in general, the number of people who can feel the vibration is 55 dB os vibration degree is a little bit small. Most people can feel the vibration in 60 dB even some people can't feel. Therefore, most scholars are saying that 55 dB of vibration degree is a normal state of one. If one is continuously vibrating over 90 dB, circulation organs, digestion organs, and internal secretion organs will change(Sackler, 1960). If a person is vibrating per 30 minutes for 8 hours by 60 dB, it doesn't bother sleeping. If vibration degree is 65-69 dB, the reaction occurs when one is not totally sleeping. If it is over 74 dB, one gets influence even he is sleeping deeply. And one could bear the vibration acceleration of up to 145 dB for a short period of time. However, in the case of mice, cats, and dogs, they were almost dead when the vibration acceleration of 140 dB from 5 to 50 Hz frequency is given to them (Kim, 1994). For maintenance of working efficiency, the permitted vibration limit is 83 dB in the case of 24 hours of work, 90 dB in the case of 8 hours of work, 100 dB in the case of 1.5 hours or work, and 110 dB in the case of 1 minute of work (Moll, 1976; Marvin, 1984).

4.5. Damage of human pregnancy on account of noise and vibration

These days, one thing that arouses people's interest among the research on noise level is the problem of how the exposure of working women to noise is related to their pregnancy and birth delivery (Zhang, 1992). The effects of excessive noise produced in the work site on pregnant woman are that the birth rate of short-weighted and congenital deformed babies are high, and uteroplacental blood flow can occur. And fetal hypoxia can occur, and catecholamine which is a neurotransmitter increases in the mother's body (Cavedon, 1987). So we know that these are related to the death of unborn babies and causes miscarriage. But there will be a limit on the report that exposure to noise causes newborn babies within 7 days to die. Moreover, noise during the pregnancy and birth delivery can disturb the internal development of urinary and genital organs, or it can cause an unborn baby to die or have deformation in case of many animals, too(McDonald, 1988). It would be proper to consider these phenomenon as secondary effects by excessive or insufficient secretion of hormones, rather than as direct effects of noise. For example, the sound of an explosion can give a physiological shock to a dairy cow, and if this shock is repeated, a miscarriage occurs as the baby and mother's placenta get apart each other because of nervous anxiety, shrinking of the uterus, and abrupt unbalance of internal secretion with increase of amniotic fluid (Ando, 1973; Jerrett, 1984; Mayer, 1989).

4.6. Damage of dog pregnancy on account of noise and vibration

The beginners who are breeding a dog have difficulties taking care of birth and need a lot of information in order to take care after birth. The lack of nursing maternal dogs causes a lot of problems. This is caused by the lack of behavior of a normal dog. The ideological and environmental condition of preparations for nursing and giving a birth are the best way to take care of dog without deficiency (Lane-Petter, 1963; Hafez, 1970). The maternal dog seldomly faces diseases which are caused by polluted soil. The dog needs

preparation which helps the dog not to be exposed to the polluted soil. A healthy dog is relaxed and laterally recumbent with a warm, sleek coat, bright-red mucosa and good muscle tone. It is capable of strong movement and sucking (Kaneko, 1971). Chilled dogs become noisy and initially overactive, with an increased respiration rate from about 20 to 40/min and decreased rectal temperature from approximately 36℃ to as low as 21℃. So The artificial breeding system makes a constant temperature of 29℃ in the first week and decreases by 21-24℃ (Miller, 1964; Allen, 1985; Olson, 1987).

5. Conclusion

In conclusion, opinions about the damage from noise is thought that it would rather come from other factors than come from explosive noises. Because the expensive dog was bred in a container made of metal and the general dogs like Dosa and Jindo were bred around the house. The dog which is in the written petition paper was bred in a container-pet house, which is below 50 dB of noise level if the explosive noise level is 80 dB. These results tell us that a dog's miscarriage comes from unsanitary environment including the circulation of air, packed breeding and the deficiency of excercise in a dog rather than noise. There is no record that a dog's miscarriage is caused by noise. The influence of explosion noise to fill up the seashore of the J village in T city in human and animal is the highest when it is over 1000 Hz, 80 dB in an uncomfortable level. If somebody hears over 6 hours per day for one month, the hair cell of the Corti's organ will be changed and other tissue of abnormality will be able to cause hearing loss. The one thing we can surely assure is that miscarriage is not caused by noise. It is caused by other reasons, but if the noise level is suddenly over 100 dB, the animals can have a miscarriage.

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