VETERINARY MEDICINE AND A NEW LOOK AT BEEKEEPING

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PREFACE

Founded in 2010, İKSAD; In many regions in Turkey and sixteen different countries operating in various fields such as domestic and international congresses, it is a scientific organization. International publishing activities are solely scientific and cover academic studies. For this purpose, the international publishing house and international It sheds light on science with indexed and refereed journals. İKSAD started its publishing life in 2014 with the license number 2014/31220 of the Ministry of Culture.

In this book, five different chapters written by researchers who are experts in their fields are presented to valuable scientists. On behalf of all the authors who contributed to the writing of the book, I would like to thank İKSAD for giving us the opportunity to contribute to science.

Assist. Prof. Dr. Tuba Özge YAŞAR

EDITOR

CHAPTER 1

CORNEAL DISEASES IN VETERINARY OPHTHALMOLOGY

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INTRODUCTION

In order to shape the image; The beams of light coming to a healthy eye need to be properly focused in the layer at the back of the eye called the "retina". The light coming to the eye for this to occur; The tear layer must pass through a number of special tissues called cornea, anterior chamber, lens crystal, and vitreous, and finally fall to the retina. All of these textures have a specific crushing ratio. Each tissue refracts the light in specific proportions, allowing the image to focus on the retina. For this reason, if any irregularity or deterioration occurs in the structure of all these tissues, which are involved in the light transfer, the quality of vision decreases, and in some serious cases, blindness may occur. Lens crystal; It is a transparent lens and it has the highest rate of refraction. Another tissue with a very high rate of refraction is the cornea, so visual quality is negatively affected in cases such as any blurring, deformity, inflammatory reactions in the corneal tissue.

1. BRIEF INFORMATION ABOUT CORNEA ANATOMY

Cornea; It is located in front of the outer layer of the eyeball (Tunica fibrosa bulbi). It has a domed shape with convex and concave faces. It is transparent and avascular. It contains protein, albumin, globulin, and collagen in its structure. Collagen is important for healing reactions, especially in corneal damage. Corneal oxygenation and nutrition; It is provided by humor aqueous, precorneal tears, limbal capillary network, and dialysis from the palpebral conjunctiva. Between the sclera and the Cornea, there is an area in the form of a

circle called the "limbus cornea" surrounding the horn (Dursun 2000, Akın and Samsar 2005). Since the cornea has a very sensitive and sensitive neural network, severe pain and photophobia can occur during the course of diseases that affect this tissue (Akın and Samsar, 2005). When corneal tissue is examined histologically, there are four different layers from cranial to caudal. In some sources, a total of five layers are mentioned because the pre-corneal tear layer is also included in them. These:

1. Precorneal tear layer

2. Epithelium Cornea and basement membrane

3. Stroma

4. Lamina limitans posterior (descement)

5. Endothelium (Maggs et al., 2008, Akın and Samsar 2005).

Cornea diameter values vary according to animal species. For example, cornea diameter in dogs is 12.5 X 17mm, corneal thickness is 0.73-0.95mm in the center and 0.6-0.8mm in the periphery. In dogs, the corneal epithelial layer is 0.08mm and the stroma is 0.5-0.6mm thick, which is 90% of the entire corneal thickness. (Akın and Samsar, 2005).

Corneal diseases that are caused by many reasons of congenital or acquired origin are quite common in veterinary ophthalmology. Since it has a very tight structure in terms of its avascular feature and

histology, pathological inflammatory reactions take shape slowly, but chronicity of the disease reduces the rate of positive response in treatment. For this reason, taking an accurate anamnesis, systematic eye examination, determining a treatment protocol that is suitable for the diagnosis of the disease in the shortest time has an important place in veterinary ophthalmology.

2. CLINICAL EXAMINATION

In veterinary medicine, the patient must first be prepared for ophthalmological examination. Restraint of patients who are angry and aggressive is required. In some cases, sedative-anesthetic agents may be administered to such patients. This is not necessary for patients with a calm and harmonious temperament. In addition, proper handling of the patient by an assistant facilitates the physician's examination.

An eye examination requires both a light and a dark environment. For this reason, eye examination rooms should be environments that do not receive light from outside, if possible, that can be turned into a dark room if desired. The inspection takes an important place in the examination. Biomicroscopic examination; consists of three main methods called direct illumination, scleral illumination, and retro illumination (Aydın et al., 2001). In veterinary medicine, special devices called a direct ophthalmoscope, indirect ophthalmoscope and slit-lamp, designed only for an eye examination, are used for this purpose. In this way, it is possible to inspect the eyelids, conjunctiva,

iris, lens, sclera, cornea, retina, and optic nerve structures. For the inspection of the lens crystal, vitreous, retina, optic nerve, mydriatic agents should be dropped on the eye and examined after mydriasis is formed.

3. CONGENITAL KORNEA ANOMALIES

Congenital anomalies are disorders of genetic origin that occur from birth. Congenital anomalies in the cornea are mostly accompanied by eyeball (bulbus ocular) anomalies. However, in some rare cases, they can occur alone.

3.1. Corneal Dermoid - Cyst Dermoid

Congenital means present at birth. It is not synonymous with hereditary (Samad, 2008). It is a piece of skin that originates from the cornea, sclera, or conjunctiva and has a hairy structure on it. This piece of skin is localized partially or completely on the cornea. It can be bilateral or unilateral with other ocular malformations. Hairs on the dermoid mechanically irritate the eye (Barkyoumb and Leipold, 1984; Greene et al., 1973; Moore et al., 1999). Ocular dermoid prevalence in cattle is estimated to be between 0.002% and 0.4% (Yeruham et al., 2002).

For treatment, the dermoid formed must be removed without wasting time. For this purpose, superficial keratectomy operation is the most radical type of treatment. There are many techniques described in superficial keratectomy. After determining the depth of the lesion in

the cornea with a biomicroscope, it is decided which technique is suitable for treatment. If the depth of the lesion is more than half the total thickness of the cornea, after keratectomy, the area should be closed with a conjunctival slide flap to prevent corneal perforation. After the operation, topical antibiotics should be used and corneal regeneration should be checked at routine intervals with a fluorescein test. However, relapse can occur in some cases (Gelatt, 2008).

3.2. Micro Cornea

The fact that the cornea is smaller than it should be is called the micro cornea. It mostly occurs with microphthalmos. Microcornea phenomenon is more common in some dog breeds such as Poodle and Miniature Schnauzer. There is no cure (Akın and Samsar, 2005).

3.3. Melanic Pigmentation

The pigment of melanin is found in various proportions in eye tissues, but its function is not fully explained. It is known that melanin pigment tends to protect against various ocular diseases that can cause blindness, including uveal melanoma and age-related macular degeneration (Hu, 2005; Sarna and Swartz 1998).

It is characterized by the partial or diffuse accumulation of melanin pigment material in the cornea, which accumulates at different levels in different tissues and organs. In some cases; It can also be formed by inflammatory infections of the eye such as choroiditis or during the course of metabolic diseases such as Addison's and diabetes mellitus.

If it does not hinder the patient's ability to see, there is hardly any need for treatment. First of all, it is recommended to treat the primary underlying disease, if any (Akın & Samsar, 2005).

3.4. Megaophthalmus

The growth of the eyeball beyond its normal volume is called megaophthalmus. This disorder is also called hydrophthalmus or buphthalmus. With the increase in intraocular pressure, volume enlargement occurs in the sclera and pupil along with the cornea. It can be shaped in all pets. It has been reported to occur with congenital glacoma cases, especially in the Cocker Spaniel dog breed. There is no definitive treatment, but intraocular pressure should be controlled (Akın and Samsar, 2005).

3.5. Permanent Pupillary Membranes and Corneal Opacities

Pupillary membrane persistence (PMP) is a congenital change characterized by fetal membrane remnants that continue as filamentous tissue throughout the pupil (Khalkhal, 2011).

During the embryonic period, the arteria hyaloide, which feeds the corpus vitreum and lens crystal, should normally shrink and disappear within a period of 6 months after birth. However, this does not happen in some cases. Permanent pupillary membranes can form focal or diffuse corneal opacities. Focal opacities are formed by the thickening and deformation of the descement membrane. In diffuse opacities, it occurs as a result of the descement membrane being affected in a

much larger area and the development of edema in the area (Gelatt, 2008). In some cases, membranous filaments can bind to the cornea and lens crystal and cause opacity or cataract development (Khalkhal et al., 2011; Sooryadas et al., 2012).

Using topical atropine to dilate the pupil can help break down PPMs. Surgery and laser intervention may be required for large opaque membranes (Gupta et al., 2003). Some researchers report that a more conservative management with Nd-YAG laser rather than intraocular surgery is an acceptable and safe way to treat patients with similar clinical manifestations (Kim et al., 2005).

4. CORNEA AND FOREIGN BODIES

Dust, soil, plants such as hordeloum type grass spikes, small pieces of metal etc. Many objects such as, accidentally come into contact with the eyes when the animals are being carried outside, walking or playing. Depending on the shape and type of foreign bodies, they cause different degrees of irritation to the eye. These foreign bodies can affect the eyelids, conjunctiva, sclera, and cornea. They can create a shallow, deep or even perforated wound on the cornea. Pain occurs in the cornea, which is very rich in nerve tissue. In addition, the patient experiences photophobia, tear discharge, malaise, and restlessness. As the event becomes chronic, it may be complicated by purulent corneal inflammation (keratitits prulenta), corneal abscess, and panophthalmia purulenta (Akın and Samsar, 2005).

The basis of the treatment is the removal of the foreign body that has sunk into the cornea and then the recovery of the damaged corneal tissue. For this purpose, first of all, it is necessary to provide the patient's restraint and apply local antiseptic drops (Novocain 1-2%) to the eye. Systemically effective sedative-anesthetic agents may be required to be administered to patients who do not allow intervention, aggressive, very mobile patients. Eyelids are ruled out with blephors. The location of the foreign body is determined. Foreign bodies that are exposed are caught with corneal forceps and taken out by pulling in the direction of subduction. If the foreign body is in the anterior chamber, paracentesis is performed. It is closed with an appropriate sewing method and material (Akın and Samsar, 2005).

In the meantime, the intraocular should be checked as humor aqueous solution may be lost. In addition, the local antibiotic type and eye should be protected under dressing for a while. Wearing an elizabeth collar on cats and dogs until recovery is appropriate, taking care of the sick eye from irritation.

5. CORNEA INJURIES

It is shaped by the loss of integrity of the corneal tissue due to various reasons. Facial, deep and perforated wounds can occur on the cornea. Facial wounds occur with superficial losses occurring in the epithelial layer of the cornea. If four layers of the cornea are affected in the injury case but the descement solid maintains its integrity, this type of wounds are called deep wounds. This type of cases can also be

complicated by descematocelle (keratocelle) (Akın and Samsar, 2005). Wounds that affect all layers of the cornea and cause contact with the anterior chamber (camera oculi anterior) with the external environment are called perforated wounds. For this reason, the treatment protocol in corneal injuries should be planned according to the cause and the depth of the corneal wound (Akın and Samsar, 2005). While warm antiseptic wet compresses, local antibiotic pomade, or eye drops can be applied to the face wounds, suture application, flap operation in deep wounds, keratoplasty operation can be performed in corneal injuries with large financial losses. Subconjunctival antibiotherapy reduces the risk of complications of panophthalmia purulenta (endophthalmitis) due to microbial infection in corneal injuries (Akın and Samsar, 2005).

6. KERATITES

All inflammatory reactions that occur in corneal tissue due to various etiological factors are called keratitis. Due to this inflammatory reaction, corneal tissue loses its transparency and becomes cloudy. Vascularization is also formed due to veins originating from the pericorneal, scleral or conjunctiva (Akın and Samsar, 2005).

There are two views in the classification of keratitis. According to one opinion, corneal inflammation; It is divided into keratitis nonsuppurativa and keratitis suppuritiva. Again, according to the same opinion, all keratitis are examined in six groups. These are: 1. Keratitis superficialis, 2. Keratitis parenchymatosa, 3. Keratitis

posterior, 4. Keratitis purulenta, 5. Ulcus cornea, 6. Leukoma (Akın and Samsar, 2005). According to another view, inflammatory corneal disorders (inflammatory keratopathies) are classified as ulcerative and non-ulcerative keratitis (Gelatt, 2008).

Ulcerative keratitis are classified as 1. Superficial corneal ulcers, 2. Stromal Corneal ulcers, 3. Descemetocele ulcers and finally 4. Perforated ulcers, depending on the depth of the corneal ulcer. Corneal ulcers are also classified according to their cause. Bacterial infections (Bacterial corneal ulcers), fungal infections (Mycotic keratitis), diseases that cause melting of the cornea (Melting corneal ulcers-Collagenase and protease-associated corneal ulcers), and chemical burns (chemical corneal ulcers) are among the most common causes (Gelatt, 2008).

Non-ulcerative corneal ulcers; 1. Pigmented keratitis (Superficial Pigmented Ketarititis), 2. Chronic superficial keratitis (Pannus, Überretither Syndrome), 3. Neurological keratitis, 4. Corneal abscess, 5. Superficial mottled keratitis, 6. Florida keratopathy (Gelatt, 2008) .

Non-inflammatory keratopathies are divided into two as crystalline and non-crystalline corneal opacities. Crystalline corneal opacities: 1. Corneal dystrophies, 2. Lipid degeneration, 3. Corneal degeneration. Corneal endothelial dystrophy is one of the non-crystalline corneal opacities (Gelatt, 2008).

It heals rapidly with superficial corneal ulcers becoming widespread. This should only be sufficient to prevent medical treatment of topical antibiotics, mydriatic-cycloplegic agents and artificial tears, prevent or remove infection, alleviate discomfort, and facilitate healing (Slatter 1990; Kern 1990). Surgical intervention may be considered for deep corneal ulcers, corneal ulcers, and stromal dissolving corneal ulcers (Whitley, 1991). Descemetocoele and perforated corneal surgery are considered emergency. Surgical treatment options vary according to the size and depth of the corneal defect (Wilkie and Whittaker 1997). The most important features of deep corneal treatment are to provide mechanical support to the weakened cornea and to stop progressive corneal damage with proper medical treatment (Boruchoff and Foulk 1990).

Several surgical techniques have been reported, such as the corneo-scleral flap (Slatter 1990), conjunctival grafts (Boisjoly et al., 1989), the third eyelid flap (Gelatt 1995), and a corneal transplant (Severin 1995). In addition, various collagen and contact lenses are used to protect deep corneal ulcers, descemetocoeles and perforating ulcers (Honig and Rapuano 1997).

7. CORNEASCLERAL MASS AND NEOPLASES

Corneal, limbal, and corneal-scleral mass formation is rare in dogs. Among these masses, cysts, abscesses, and inflammatory masses (nodular granulomatous episcleritis) are among the non-neoplastic ones. However, neoplasms such as melenoma, papilloma, lymphoma

and squamous cell cancer may also occur. Depending on the character of the mass, keratectomy, mass excision, patch and cryotherapy techniques can be applied (Gelatt, 2008).

CONCLUSION

Eye diseases are quite common in veterinary practice. Corneal diseases also have an important place among them. Success is achieved in many cases with the correct diagnosis and treatment of the disease. In light of the developing technology, scientific researches, and experiences, the point we have reached today is not underestimated. However, of course, the development of many different techniques and treatment methods in the future will increase the success rate in treatment.

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CHAPTER 2

EFFECT MECHANISMS OF ACUPUNCTURE

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INTRODUCTION

Acupuncture is one of the oldest medical sciences in the world in which many diseases are treated by stimulating special points in the body using very fine gold, steel and silver needles (Atalar et al., 2013; Cabıoğlu and Ergene, 2003; Cheng, 2011; Günday, 1997; Horasanlı et al., 2008; Horasanlı, 2009; Kalyon, 2007; Loken, 2001; Zhao, 2008; Nur and Teke, 1995). It is known that this medical science, which started with the use of needles (Bian) made by sharpening stones in the Far East thousands of years ago, dates back even to Shen Nung, who is known as the father of Chinese Medicine. The term acupuncture was first used in the Classical Internal Medicine book, Huang Di Nei Jing, written during the Yellow Kingdom period of China. The first work in the field of veterinary medicine is the book Bai-Le-Zhen Jing (Baile's Principles of Veterinary Acupuncture) written between 659-621 BC (Altug, 1998; Cheng, 2011; Günday, 1997; Horasanlı et al., 2008; Imrie et al., 2001; Kavakli, 2010; Li et al., 2015; Lindley and Cummings, 2006; Nur and Teke, 1995).

Acupuncture, which has an important place in Eastern medicine for thousands of years, has gained an increasing popularity in western medicine for the last 50 years. The most important event in this ancient medical science's opening to the west and gaining popularity is that in 1971, the US President Richard Nixon saw him during his visit to China and later sent doctors from his country to learn acupuncture. The prohibition of acupuncture in some periods throughout history and the treatment used by the local people caused a delay in its use in

western civilizations. The difficulty of evidence-based western medicine in explaining the mechanism of action of acupuncture has also led to the late acceptance of acupuncture by western medicine (Cheng, 2011; Colquhoun, 2013; Gecioglu and Gecioglu, 2014; Horasanlı et al., 2008; Kalyon, 2007; Kavakli, 2010; Leventoglu, 2018; Ulett, 1998).

1. THEORIES EXPLAINING THE MECHANISM OF ACTION OF ACUPUNCTURE

1.1. The Theory Explaining the Mechanism of Action of Acupuncture According to Traditional Chinese Medicine

According to Traditional Chinese Medicine, a life energy called Chi (Qi) controls all organs and systems in the body. Chi energy moves from one end of the body to the other by following certain lines called meridians that contain acupuncture points (Ekben, 2005; Kalyon, 2007; Lee et al., 2004; Li et al., 2015; Povolny and Ac, 2008).

According to the theory of Traditional Chinese Medicine, Chi energy emerges as a result of the interaction between Yin and Yang poles, and living beings are considered healthy in the balance of these two poles. Representing negative forces (such as cold and calm), Yin provides the storage and preservation of internal energy in the body. Yang, which represents positive forces (such as warmth and growth), deals with the use of energy (Anonim, 2014; Günday, 1997; Kalyon, 2007; Klide and Kung, 1993; Lazano, 2014; Lee et al., 2004).

According to Traditional Chinese Medicine theory, imbalances between Yin and Yang poles cause Chi energy to be blocked. According to traditional Chinese medicine, this is a disease. In acupuncture treatment, special points on the meridians are stimulated to eliminate the incompatibility between Yin and Yang poles (Günday, 1997; Kalyon, 2007; Povolny and Ac, 2008).

Traditional Chinese Medicine classifies organs and systems in the body according to the five element theory. The elements these elements and organs belong to are given in the table below (Table 1).

Table 1: Organs Represented by the Elements According to the Theory of the Five Elements

Element	Organs Represented
Wood	Liver, Gallbladder
Fire	Heart, Small Intestine
Earth	Spleen, Stomach
Metal	Lung, Large Intestine
Water	Kidney, Bladder

According to the theory of five elements, vital energy called Qi circulates in the body with two kinds of cycles. One of them is the Sheng Cycle and the other is the Ko Cycle (Horasanlı et al., 2008; Lazano, 2014). According to the Sheng cycle, Chi energy supports its development while passing from an element to the next element (mother-son relationship); according to the Ko cycle, when Chi energy passes from an element to the next element, it prevents its

development by weakening its effect (Master-servant relationship) (Figure 1) (Horasanlı et al., 2008; Lazano, 2014). For example; in the case of dyskinesia of the gallbladder, which is an organ of the tree element, there is an increase in peristaltic movements in the small intestine from the organs of the fire element, and pain in the heart area. This situation is interpreted as the stimulating effect of the wood element on the fire element in Traditional Chinese Medicine. Again, in case of severe infection in the gallbladder, the movements of the back stomach tissues from the organs of the earth element are limited. This situation arises from the suppressive effect of the wood element on the earth element, which is caused by the Ko cycle in traditional Chinese medicine (Anonim, 2014; Lazano, 2014).

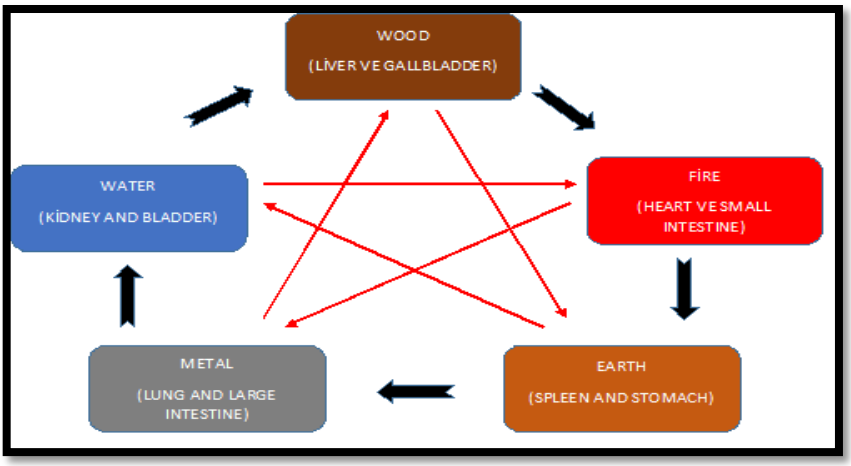

Figure 1. Sheng Cycle (Black arrows), Ko Cycle (red arrows)

2. THEORIES EXPLAINING THE EFFECT MECHANISMS OF ACUPUNCTURE ACCORDING TO WESTERN MEDICINE

2.1. Neurological Theories

2.1.1. Viscerocuteneal and Cutenovisceral Reflex Theory

According to this theory, acupuncture applications on some special points on the skin affect the functions of organs that have neural connections with these points. Somatosensory stimuli from the skin or muscles affect the internal organs by controlling various autonomic functions. In this way, visceral organ disorders are treated with acupuncture applications on the Back-shu, Front-mu and Huatuo-jiaji points (Cabıoglu, 2008; Cabıoglu, 2009; Cabıoglu, 2016).

Back-shu acupuncture points are points located in the back area. Each of the back-shu points is related to an internal organ and is located on the same plane with the organ to which it is related. For example; the Back-shu point of the kidneys is at the same level as the kidneys (O'connor and Bensky, 1988). It affects visceral activities such as enlargement of the bronchi, heart rate, motility of the gastrointestinal system, acid level of the stomach, contractions of the bladder and the release of pancreatic secretions (Cabıoglu, 2008; Cabıoglu, 2016; Sovijarvi and Poppius, 1977).

Front-mu acupuncture points are special acupuncture points located on the chest and abdominal wall. They are effective points in pathological conditions occurring in the organs of the gastrointestinal

system, gallbladder and urinary bladder (Cabıoglu, 2009; Sovijarvi and Poppius, 1977; Xinnong, 1987; Zhang, 2006). Sensitivity at the front-mu points can also help diagnose diseases. For example; GB-24 in gallbladder diseases; KID-12 in stomach diseases; sensitivity may occur in LU-1 in lung diseases and ST-25 in colon diseases (Cabıoglu, 2009; Maciocia, 1989; Xinnong, 1987).

Huatuo-jiaji acupuncture points are points located on both sides of the spine between the T1-L5 vertebrae. Acupuncture is applied using these points in the treatment of various disorders in the cardiovascular system, urogenital system, and gastrointestinal system Cabıoglu, 2008; Cabıoglu 2016).

2.1.2. Gate-Control Theory

Gate-control theory, one of the theories explaining the analgesic effect of acupuncture, was put forward in 1965 by R. Melzack and P. Wall. According to the gate-control theory, whether the gates in the central nervous system are open or not determines whether the sensation of pain is transmitted. According to this theory, the sense of pain is formed as a result of impulses above a certain level reaching the thalamocortical system. The gates in substantia gelatinosis control the flow of these impulses above a certain level towards the thalamocortical system. Group A delta nerve fibers surrounded by myelin carry pain sensations to these gates in substantia gelatinosis. Unmyelinated C fibers, on the other hand, block these gates and prevent the passage of pain sensation. With acupuncture applications, unmyelinated C fibers are stimulated and pain is prevented due to the

closing of the doors and consequently the impulse flow (Aydın, 2002; Cabıoglu, 2016; Captug and Bilgili, 2005; Hadjistavropoulos and Craig, 2004; Kalyon, 2007; Marangoz, 1993).

2.1.3. Motor-Gate Theory

The motor gate theory, proposed by Anton Gayasuriya in 1977, is a neurophysiological model developed to explain the effectiveness of acupuncture in motor dysfunction such as paralysis. The structure called motor gate is a functional complex formed by the anterior horn cells, Renshaw cells, Cajal cells and their neuronal connections. When a central nervous system malfunction occurs due to any reason, this complex structure called motor gate becomes pathologically closed. According to the motor gate theory, if the motor gates are closed due to any pathological condition in the nervous system, the lower motor neurons cannot show their functions and therefore the impulses cannot reach the muscles. In this case, it reveals motor dysfunction such as paralysis (Gayasuriya, 1979).

Acupuncture is seen as a simple, unique and physiologically rational treatment method to open these doors when the motor doors are closed. Although this door cannot be opened using methods such as electrotherapy or physiotherapy, motor gates can be activated in both directions and fully or partially opened with acupuncture applications, both by sending strong afferent impulses and by stimulating the motor nerves antidromically (Altuğ, 1998; Gayasuriya, 1979; Ziyal, 1989; Tekeoglu, 1989).

2.1.4. Humoral Theories

Another view on the mechanism of action of acupuncture is the theories arising from the activity of neurotransmitter and neurohumoral substances. Many neurotransmitter substances and substances with neurohumoral properties take part in acupuncture activity (Altuğ, 1998; Captug and Bilgili, 2005).

2.1.5. Serotonin (Hydroxy Tryptamine) Theory

5-hydroxy tryptamine, known as serotonin, is found in chromaffin cells in the gastrointestinal system, platelets and central nervous system (Tekeoglu, 1989).

Acupuncture applications cause changes in serotonin levels released from the central nervous system and gastrointestinal system. These changes in the serotonin level help acupuncture explain its mechanism of action. The increase in serotonin level released from the central nervous system with acupuncture applications makes people feel good and happy. This explains the use of acupuncture to maintain and provide psychomotor balance. This mechanism of action underlies the use of acupuncture in the treatment of diseases such as depression (Cabıoglu and Ergene, 2003; Cabıoğlu, 2016; Lee and Hsu,2014).

The increased serotonin level with acupuncture applications also explains the analgesic effect of acupuncture. The increase in the amount of serotonin reduces nociceptive pain in the nucleus raphe magnus in the brainstem. Studies show that there is a decrease in acupuncture analgesia when serotonin receptors are blocked. This

shows the importance of serotonin in the analgesic effect of acupuncture (Cabıoglu and Ergene, 2003; Cabıoğlu, 2016; Lee and Hsu, 2014).

There are also changes in the level of serotonin released from the gastrointestinal system with acupuncture applications. Serotonin released from Chromaffin cells controls the movements of the muscles in the gastrointestinal region. Some studies show that stimulation of the ST-36 acupuncture point with electroacupuncture decreases visceral sensitivity and creates an analgesic effect by serotonergic route in rats with chronic visceral sensitivity (Camilleri et al., 2000; Li et al., 2015; Tian et al., 2006). In many studies, it was found that when electroacupuncture was applied to the ST-36 acupuncture point in rats with chronic visceral hypersensitivity, which is a characteristic of irritable bowel syndrome, visceral sensitivity decreased and an analgesic effect was created by serotonergic route (Li et al., 2015).

2.1.6. Endorphin Release Theory

Endogenous opioids are polypeptides that exhibit morphine-like activity, such as endorphins, enkephalin, and dinorphins produced by the living organism itself. In addition to their pain relieving effects, endogenous opioids also have anti-inflammatory, immunomodulatory and metabolic effects (Altug, 1998; Cabıoglu, 2001; Cabıoglu, 2016; Kalyon, 2007).

One of the theories explaining the analgesic effectiveness of acupuncture is the endorphin release theory. Acupuncture applications

increase the concentration of endogenous opioids (beta endorphin, enkephalin and dinorphine) in the brain. Endogenous opioids show their analgesic effect by binding to μ (mu), δ (delta) and κ (kappa) receptors, preventing the presynaptic release of excitatory neurotransmitters and the passage of calcium ions through the membrane (Altug, 1998; Cabıoglu, 2001; Cabıoglu, 2016; Kalyon, 2007; Lee and Hsu, 2014).

The radioimmunoassay technique has been found that electroacupuncture applications increase the amount of endogenous opioids (Altug, 1998; Kalyon, 2007). The use of low frequency wave (2-15 Hz) increases the amount of beta-endorphin, enkephalin and endomorphine. These endogenous opioids, on the other hand, show an analgesic effect by binding to the μ (mu) and δ (delta) receptors. In case of using high frequency wave (100 Hz), dinorphine shows analgesic effect by binding to κ (kappa) receptors on the spinal cord (Altug, 1998; Captug and Bilgili, 2005; Kalyon, 2007; Lee and Hsu, 2014).

The lack of analgesic effect of acupuncture in mice undergoing pituitaryectomy and the ineffectiveness of acupuncture in mice that do not have opioid receptors genetically enabled the endorphin release theory to explain acupuncture analgesia one step ahead of other theories (Altug, 1998). In a study conducted, it was found that acupuncture analgesia increased due to the increase in betaendorphin and leucine enkephalin secretion by stimulating reticularis paragigantocellularis lateralis (RPGL) in rats with electroacupuncture

application, while the effect of acupuncture analgesia was reduced in rats with RPLG lesions (Cabıoglu and Ergene, 2003; Zhao, 1995).

The immunomodulatory effect of acupuncture can also be explained with the endorphin release theory. Endogenous opioids such as endorphin and enkephalin, whose release increases during acupuncture applications, are physically and biochemically similar to the opioid receptors of the neuroendocrine system. Therefore, these neurotransmitter substances create an immunomodulatory effect by binding to opioid receptors on immune system cells (such as B-lymphocyte, T-lymphocyte, natural killer (NK) cells and granulocytes) (Cabıoglu, 2001; Cabıoglu, 2016; Captug and Bilgili, 2005; Kalyon, 2007). In a study investigating the immodulatory effect of electroacupuncture, it was found that NK cell activation and interferon gamma levels increased less in mice administered 10 mg / kg naloxane prior to electroacupuncture than in mice without naloxane. In this case, it shows that the immunomodulatory effect of acupuncture stems from endogenous opioids (Cabıoglu and Ergene, 2003; Yu et al., 1998).

The most important metabolic effects of acupuncture are lipolysis and hypoglycemia by causing insulin increase in diabetic conditions. In diabetic mice, hypoglycemia occurs with the increase in insulin due to the increase in plasma beta-endorphin level with the application of electroacupuntur to the CV-12 acupuncture point (Cabıoglu, 2001).

Acupuncture is also used to treat gastrointestinal mucosal lesions that develop due to excessive gastric acid secretion (Li et al., 2015; Schubert, 2014). Further damage to the mucosa is prevented by suppressing gastric acid secretion with the effect of beta-endorphin and somatostatin that increase in plasma with acupuncture applications (Li et al., 2015; Lenz et al., 1986; Jin et al. 1996). In studies conducted, it was found that electroacupuncture was applied to ST-36, PC-6 and BL-20 points, and gastric acid secretion decreased significantly compared to the control group. (Bouin et al., 2002; Li et al., 2015).

2.1.7. The Theory of Release of Other Neurotransmitter Substances

It is known that acupuncture is effective in norepinephrine, substance P, dopamine, acetylcholine, gamma amino butyric acid, glutamate, cyclic AMP and calcium ions, in addition to endogenous opioids (Altug, 1998; Captug and Bilgili, 2005).

2.1.8. Bioelectrical Theories

Bioelectrical theories developed in order to explain the effect of acupuncture have been developed by combining the approach of eastern and western medicine to acupuncture. In Western medicine, the view that the bioelectric current in the diseased area is out of its normal state is similar to the view that the life energy called Qi in the diseased area is interrupted in eastern medicine. It is also similar to the

purpose of western medicine to regulate the bioelectric current in the diseased area, with the aim of balancing the Qi energy of eastern medicine (Altug, 1998).

CONCLUSION

Acupuncture, one of the oldest known medical sciences, is one of the most popular treatment options in the east for thousands of years and in the west especially for the last 50 years. Acupuncture therapy, which is used especially for its analgesic effect, is one of the popular treatment options in human medicine, which is also used for the cessation of smoking and weight loss due to its lipolytic activity. In veterinary medicine, acupuncture, which is mostly used in the treatment of anesthetic, analgesic and motor dysfunctions, is thought to have many more effects and mechanisms of action waiting to be discovered. Especially in recent years, it is thought that this medical science, which has an immune modulator effect and stopping the development of tumoral cells, will gain more importance in the future and its popularity will increase even more after thousands of years.

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CHAPTER 3

HIP DYSPLASIA IN DOGS

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INTRODUCTION

1. GENERAL INFORMATION ABOUT HIP DYSPLASIA

Hip dysplasia is an orthopedic problem characterized by the biomechanical impairment of the coxae-femoral joint, mostly in dogs (Çaptug and Bilgili 2007, Ginja et al. 2006, Karabaglı et al. 2014, Özdemir et al. 2006, Sarı and Bilgili 2011). The first studies on hip dysplasia in dogs were conducted in the United States in the 1930s. Hip dysplasia was first described by Schnelle in 1935 as bilateral luxation of the coxaefemoral joint (Bostancı and Demirkan 2017, Brass and Paatsama 1983, Güzel and Altunatmaz 2006, Schachner and Lopez 2015, Schnelle 1935, Smith 1997, Tano et al. 1998).

Although hip dysplasia is a hereditary disease, nutrition, weight, anomalies of pelvic muscles and joint laxity are important factors in the formation of the disease. Therefore, it is defined as a multifactorial disease. In addition, hip dysplasia is a disease with progressive character (Alexander 1992, Durmuş and Han 2005, Fossum 1997, Güzel and Altunatmaz 2006, Karabaglı et al. 2014, Kealy et al. 1992, Tano et al. 1998, Yaprakçı and Kaya 2014).

The disease, which occurs with laxity in the coxaefemoral joint at an early age, may result in subluxation or luxation as the age gets older. Osteoarthritis occurs primarily in the joint due to coxaefemoral incompatibility. As time passes, degenerative joint disease occurs. As a result of this biomechanical defect of the coxaefemoral joint, the acetabulum loses its concave structure. Caput ossis femoris loses its

rounded structure due to degenerative changes and takes an irregular appearance (Çaptug and Bilgili 2007, Karabaglı et al. 2014, Morgan 1992) (Figure 1).

Figure 1: Normal hip radiography in dogs (a), dysplastic hip radiography (b) (Anonim (a) 2020).

Although hip dysplasia is mostly encountered in large and giant breed dogs (German Shepherd, Saint Bernard, Golden Retriever etc.), it can also be encountered in small breed dogs. The fact that studies on breed predisposition are based on patient records and clinical symptoms are more difficult to see in small breed dogs cause problems in obtaining real data on breed predisposition. Rapid growth and weight gain in large and giant breed dogs are among the preliminary causes of hip dysplasia. This is considered to be one of the reasons why the disease is mostly seen in large breed dogs (Dassler 2002, Güzel and Altunalmaz 2006, Karabaglı et al. 2014, Yaygıngül and Sarıerler 2013) (Figure 2).

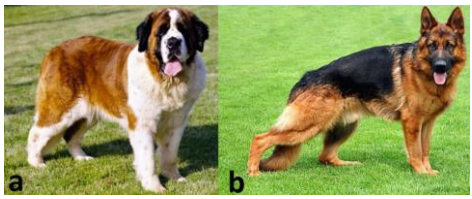

Figure 2: Dog breeds in which hip dysplasia is common, Saint Bernard (a) German Shepherd Dog (b) (Anonim (b) 2020)

Dogs with a genetic predisposition to hip dysplasia are often born with a normal hip joint. In puppies whose joint laxity is formed when they are about two months old, degenerative joint disease occurs at the age of four to six months (Alexander 1992, Çaptug and Bilgili 2007, Fox et al. 1987, Karabaglı et al. 2014, Sarı and Bilgili 2011, Yaygıngül and Sarıerler 2013, Waxman et al. 2006).

2. ETIOLOGY OF HIP DYSPLASIA

Hip dysplasia is a multifactorial disease. Heredity, nutrition, weight, excessive exercise, pelvic muscle anomalies and joint laxity are among the most important reasons (Alexander 1992, Durmuş and Han 2005, Fossum 1997, Güzel and Altunalmaz 2006, Karabaglı et al 2014, Tano et al.1998, Yaprakçı and Kaya 2014, Yaprakçı and Tekerli 2015).

Heredity is the most important cause of hip dysplasia. Although most of the hereditary diseases in dogs occur with a single point mutation, hip dysplasia occurs with a polygenic inheritance mechanism. A study on Setter dogs reported a strong positive relationship between parents and their puppy's hip anatomy (Wood et al. 2000, Yaprakçı and Tekerli 2015). In a study on Labrador Retriever dogs, the relationship between the parents and their puppy's of hip dysplasia was investigated. As a result, it has been reported that female parents genetically affect female offspring, while male parents genetically affect male offspring (Wood et al. 2002, Yaprakçı and Tekerli 2015) . In some studies, it has been concluded that hip dysplasia does not have a predisposition related to gender (Rettenmaier et al. 2002,

Stanin et al. 2011, Yaprakçı and Tekerli 2015). In some studies, they reported that the risk of hip dysplasia in male dogs is higher than in female dogs (Wood et al. 2002, Yaprakçı and Tekerli 2015).

Various studies have reported that the heritability of hip dysplasia is on average 0.2-0.4 (Malm et al. 2007, Todhunter 2003, Yaprakçı and Tekerli 2015). In a dog with a heritability of 0.4, hip dysplasia is due to 40% genetics and 60% environmental conditions (Mäki 2004, Yaprakçı and Tekerli 2015). The most important environmental factors are care and feeding. High energy and ad-libitum nutrition is one of the most important predisposing causes of hip dysplasia. Some studies show that dogs fed ad-libitum have a higher risk of developing hip dysplasia than dogs fed controlled diets (Kealy et al. 1992, Yaprakçı and Tekerli 2015).

Hip dysplasia is a disease mostly seen in large breed dogs such as Saint Bernard, German Shepherd Dog, Golden Retriever. The fact that studies on breed predisposition are based on patient records and clinical symptoms are more difficult to see in small breed dogs cause problems in obtaining real data on breed predisposition. One of the causes of hip dysplasia in large breed dogs is rapid body development (Durmuş and Han 2005, Güzel and Altunalmaz 2006, Özdemir et al. 2006).

Excessive exercises done during the growth period in dogs is one of the important causes of hip dysplasia. It is unlikely that physiological exercises will cause dysplasia. If dogs at risk of dysplasia are

exercised excessively, the risk of hip dysplasia increases as the hip joint will be strained (Başa 2012).

3. CLINICAL FINDINGS AND DIAGNOSTIC METHODS OF HIP DYSPLASIA

3.1. Clinical Symptoms of Hip Dysplasia

Although hip dysplasia is mostly bilaterally formed, it can sometimes occur unilaterally. Dogs with hip dysplasia have signs of lameness, exercise intolerance, and jumping walking like a rabbit (bunny hop). Dogs have difficulty standing up after rest. In chronic cases, atrophy of the hind leg muscles is observed. Patient owners often complain of abnormal walking and decreased physical activity in their dogs (Çaptug and Bilgili 2007, Dassler 2002, Denny et al. 2000, Durmuş and Han 2005, Güzel and Altunalmaz 2006, Karabağlı et al. 2014, Schachner and Lopez 2015).

3.2. Clinical Diagnostic Methods

In cases where hip dysplasia is suspected, although clinical tests are not specific for hip dysplasia, they are important in detecting anatomical defects that are the preliminary causes of hip dysplasia. Clinical tests that can be performed when hip dysplasia is suspected are measurement of reduction angle, measurement of subluxation angle, ortholani test, barlow test and barden test.

3.2.1. Measurement of Reduction and Subluxation Angles

3.2.1.1. Measuring Reduction Angle

During the reduction of the hip joint, the angle between the iliopectineal protrusion and the medial edge of the knee joint is called the reduction angle. When measuring this angle, the dog is placed in a ventrodorsal position after general anesthesia. After a hand is placed lateral to the knee joint, the hip joint is placed in a vertical starting position without flexion. Then, the legs are abducted. During abduction, the angle of reduction is measured when the hip joint is in place (Figure 3). In cases where the hip anatomy is normal, the reduction angle cannot be determined (Başa 2012, Çaptug and Bilgili 2007, Dericegöz 2011, Karabaglı et al. 2014, Vezzoni 2004, Zengin 2009). The relationship between the reduction angle and hip dysplasia is as stated in Table 1.

Table 1: Relationship between angle of reduction and hip dysplasia

Reduction Angle	Hip Dysplasia Condition
20º-30º	Mild dysplasia
31º-40º	Moderate dysplasia
>40º	Severe degree of dysplasia

If the angle of reduction increases, the tension in the ligamentum teres major and joint capsule increases. As a result of this increased tension, arthrosis develops in the hip joint. As arthrosis occurs, the angle of reduction becomes increasingly narrow (Başa 2012, Çaptug and Bilgili 2007, Dericegöz 2011, Karabaglı et al. 2014, Vezzoni 2004, Zengin 2009).

3.2.1.2. Measurement of Subluxation Angle

The angle of subluxation, which is the determinant of the dorsal acetabular edge and acetabular fullness, cannot be determined in the absence of joint laxity in dogs. Subluxation angle increases in cases with hip dysplasia or joint laxity (Başa 2012, Çaptug and Bilgili 2007, Dericegöz 2011, Karabaglı et al. 2014, Vezzoni 2004, Zengin 2009). The relationship between subluxation angle and hip dysplasia is as in Table 2.

Table 2: Relationship between subluxation angle and hip joint condition

Subluxation Angle	Hip Dysplasia Condition
0º- 5º	Slight looseness in the hip joint
5º- 10º	Mild to moderate hip dysplasia
> 10º	Moderate to severe hip dysplasia

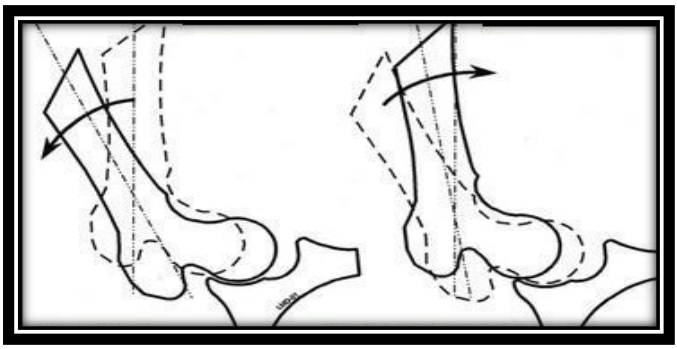

Figure 3: Measuring reduction and subluxation angles (Anonim (c) 2020)

3.2.2. Ortholani Test

The Ortolani test is an important test in the early diagnosis of coxaefemoral joint laxity, which is one of the major predisposing causes of hip dysplasia in young dogs. It is a diagnostic test based on

reduction of the hip joint in the state of luxation / subluxation. For the Ortolani test, the dog is placed under anesthesia in a lateral or ventrodorsal position. The knee joint is brought to an upright position. Then the legs are started to be placed in the abduction position. If a ticking or displacement is felt, the Ortholani test is found to be positive (Figure 4, 5) (Başa 2012, Çaptug and Bilgili 2007, Dericegöz 2011, Karabaglı et al. 2014, Puerto el al. 1999, Schachner and Lopez 2015, Vezzoni 2004, Zengin 2009).

Figure 4: Application of Ortholani test (Lateral) (Anonim (c) 2020)

Figure 5: Application of Ortholani test-2 (Lateral position) (Anonim (d) 2020)

3.2.3. Barlow Test

The Barlow test, like the ortholani test, is an important test in the diagnosis of coxaefemoral joint laxity in young dogs. It is a diagnostic

test based on moving the hip joint from the reduction to the luxation position. For the Barlow test, the anesthetized patient is placed in the lateral or ventrodorsal position. The knee joint is kept in a right angle position. The legs are brought from the abduction position to the adduction position. Barlow test is positive if the caput ossis femoris is sensed to be displaced. (Başa 2012, Çaptug and Bilgili 2007, Dericegöz 2011, Karabaglı et al. 2014, Vezzoni 2004, Zengin 2009).

3.2.4. Barden Test

The Barden test is mostly applied to dogs between the ages of 6 and 8 weeks. For the Barden test, the anesthetized patient is placed in a lateral position. While performing the Barden test, the femur is held from the craniomedial part and pressure is applied laterally. The other hand is placed on the trochanter major and pressure is applied in the medial direction. In this way, the mobility of the femoral head in and out is measured. In dogs with normal hips, there is 1-2 mm of movement from medial to lateral (Figure 6) (Başa 2012, Çaptug and Bilgili 2007, Dericegöz 2011, Ginja 2010, Karabaglı et al. 2014, Schachner and Lopez 2015, Vezzoni 2004, Zengin 2009). The relationship between hip dysplasia and the Barden test is as in table 3.

Table 3: Hip dysplasia status according to the Barden test score

Barden Test Score	Hip Dysplasia Condition
1-2 mm	No hip diplasia
3-4 mm	On the border of hip dysplasia
5-6 mm	Hip dysplasia
>6 mm	Severe hip dysplasia

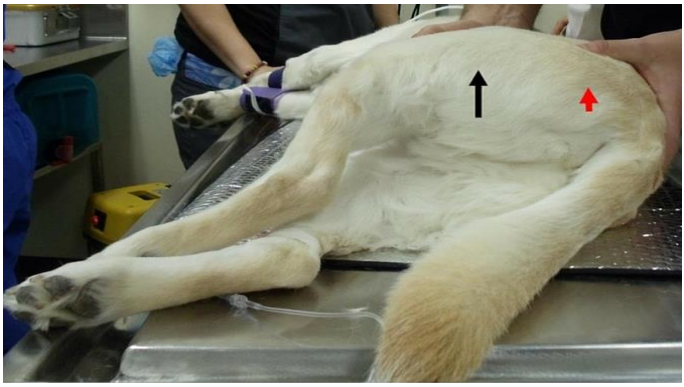

Figure 6: Application of the Barden test (Anonim (d) 2020)

3.3. Radiological Findings and Radiological Diagnostic Methods of Hip Dysplasia

The most important technique in determining the presence and degree of hip dysplasia is radiological examinations. Subluxation and degenerative changes in the joint are evaluated with radiological examination. Many techniques have been developed to evaluate radiological findings in the diagnosis of hip dysplasia.

3.3.1. Norberg-Olsson Scale

Standard ventrodorsal hip radiography is used to evaluate hip dysplasia according to the Norberg-Olsson scale. Radiography is taken by stretching the hind legs of the dog in the ventrodorsal position. While the pelvis image is taken bilaterally, the tarsal joints are rotated 15º internally, with the patella on top (Bostancı 2017, Sarı and Bilgili 2011).

When measuring the Norberg-Olsson angle, the centers of both femoral heads are marked. The Norberg angle is the angle formed by

the line between the centers of both femurs and the line drawn from the femoral center of each hip to the cranial acetabular edge(Figure 7). If the Norberg angle is 105º and above, the hip joint is considered normal. If the Norberg angle is less than 105 degrees, the degree of the angle determines the degree of dysplasia (Table 4) (Bostancı 2017, Karabaglı et al. 2014, Sarı and Bilgili 2011, Tatlı 2012, Vezzoni 2007, Zengin 2009).

Figure 7: Measurement of Norberg Olsson Angle: centers of femoral heads (A, B), cranial acetabular edges (C, D), Norberg-Olsson angles of hips (α, β) (Anonim (d) 2020)

Table 4: Degree of hip dysplasia according to Norberg-Olsson scale

Norberg Angle	Degree of Hip Dysplasia
≥ 105º	Normal hip joint
100º-105º	First degree hip dysplasia
90º-100º	Second degree hip dysplasia
< 90º	Third degree hip dysplasia
Tamamen Çıkmışsa	Fourth degree hip dysplasia

3.3.2. Federation Cynologique International (FCI) Scale

FCI is an organization that includes national dog breeding organizations in many countries of the world. FCI scoring is used to

evaluate hip dysplasia in dogs aged 1-2 years. FCI scoring is determined by evaluating the Norberg angle and the fit between the acetabulum and the femoral head. Hip dysplasia graded from A to E, based on the FCI scale (Table 5) (Bostancı 2017, Flückiger 2007, Karabaglı et al 2014, Schachner and Lopez 2015, Tatlı 2012).

Table 5: Evaluation of hip dysplasia according to FCI scoring

FCI Scale	Hip Dysplasia Condition	Norberg Angle	Degenerative Findings in the Hip Joint
A	Normal hip	≥ 105º	Acetabular femoral head compatible, no degeneration
B	Near-normal hip	100º-105º	Acetabular femoral head slightly mismatched, no degeneration
C	Mild dysplasia	100º-105º	Acetabular femoral head mismatch, mild degeneration
D	Moderate dysplasia	90º-100º	Subluxation, acetabulum and femoral head degeneration
E	Severe dysplasia	< 90º	Femoral head dislocation and severe degenerative arthropathy

3.3.3. Orthopedic Foundation for Animals (OFA) Skalası

OFA is an organization based in the United States and Canada. It uses a seven-point scoring system when evaluating hip dysplasia. According to the OFA scale, hip joint incompatibility and degenerative changes are taken into account when evaluating hip dysplasia (Table 6) (Bostancı 2017, Flückiger 2007, Karabaglı et al 2014, Schachner and Lopez 2015, Tatlı 2012).

Table 6: Evaluation of hip dysplasia according to OFA scale

OFA Scale	Hip Dysplasia Condition	The Condition of the Hip Joint
Excellent	Normal Healthy Hip	The femoral head is placed in the acetabulum with minimal joint space. Acetabulum covers almost the entire caput femoris.
Good		It is a slightly less than perfect but well-formed hip joint. Caput femoris is well embedded in the acetabulum and acetabulum caput covers the femoris well.
Mediocre		There is mild subluxation in the hip joint. Acetabulum is slightly shallow.
Borderline	Borderline	These are hip joints that cannot be agreed among radiologists on the classification as normal or dysplasic. There is more incompatibility than the hip joint, which is generally described as "mediocre". However, there are no arthritic changes that would suggest that the hip joint is definitively dysplastic.
Mild Dysplasia	Dysplastic Hip	There is partial subluxation in the femoral head. There is joint disharmony and joint space widening. Acetabulum is usually shallow and only partially covers the caput femoris. Usually there are no arthritic changes.
Moderate Dysplasia		A small part of the femoral head is covered by the acetabulum. There are secondary joint degenerations and acetabular osteophytic growths on the femoral head and neck.
Severe Dysplasia		There are clear radiographic findings of dysplasia. Caput femoris is partially or completely outside the acetabulum. There are severe secondary joint degenerations in the femoral head and neck. The acetabular edge is changed and there are very common abnormal bone pattern changes.

3.3.4. British Veterinary Association / The Kennel Club (BVA / KC) Scale

It is one of the evaluation criteria for hip dysplasia used in Britain, Ireland, Australia and New Zealand. BVA / KC is a scoring system based on the evaluation of 9 morphological criteria of the hip joint on standard ventrodorsal hip radiography (Table 7). These criteria are scored from 0 (ideal) to 6 (worst). Among these criteria, the worst score is 5 in scoring only for the caudal acetabular edge. Hip dysplasia is evaluated according to the score obtained by collecting the evaluations made for these criteria (Table 8) (Bostancı 2017, Flückiger 2007, Karabaglı et al 2014, Schachner and Lopez 2015, Tatlı 2012).

Table 7: BVA / KC criteria and score range of criteria

BVA / KC criteria	Skor
Norberg angle	0-6
Subluxation	0-6
Cranial acetabular edge	0-6
Dorsal acetabular edge	0-6
Cranial effective acetabular edge	0-6
Acetabular fossa	0-6
Caput collum femoris exocytosis	0-6
Reconstruction of the caput femoris	0-6
Caudal acetabular edge	0-5

Table 8: BVA / KC rating system comparison with OFA system

OFA	BVA / KC score (total score for both hips)
Excellent	0-4
Good	5-10
Mediocre	11-18
Borderline	19-25
Mild dysplasia	26-35
Moderate dysplasia	36-50
Severe dysplasia	51-106

3.3.5. PennHIP Scale

The most commonly used technique in distraction radiographs in the evaluation of hip dysplasia is the PennHIP technique. The PennHIP technique was developed at the University of Pennsylvania. In the PennHIP technique, anesthetized dogs are radiographed in the ventrodorsal position using a distractor. The PennHIP distractor is placed on the pelvis and the distance between the bars is adjusted to the distance between the acetabulums (Bostancı and Demirkan 2017, Karabaglı et al. 2014, Derincegöz 2011, Sarı and Bilgili 2011, Schachner and Lopez 2015, Tatlı 2012).

Distraction index is the ratio of the distance between the centers of the acetabulum and the femur to the radius of the femoral head (Figure 8). The distraction index obtained as a result of the calculation varies between 0-1. The relationship between distraction index and hip dysplasia is presented in table 9. Studies have determined that the distraction index gives the best results in dogs aged 16-18 weeks. The 0.1 degree increase in the distraction index increases the risk of hip dysplasia 4.1 times (Bostancı and Demirkan 2017, Karabaglı et al.

2014, Derincegöz 2011, Sarı and Bilgili 2011, Schachner and Lopez 2015, Tatlı 2012).

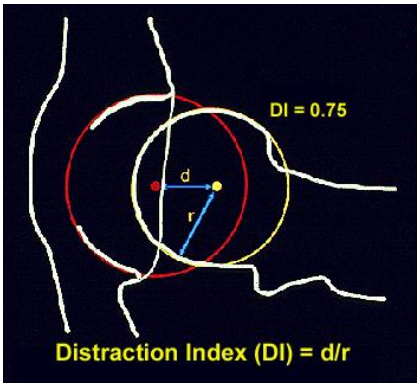

Figure 8: Calculation of the distraction index (Smith 1997)

Table 9: Relationship between distraction index and hip dysplasia

Distraction Index	Hip Dysplasia Condition
0	Perfect hip joint
≤ 0,3	Low rate of developing hip dysplasia
0,3 - 0,7	Moderate risk of developing hip dysplasia
≥ 0,7	High risk of developing hip dysplasia
1	Fully luxated hip joint

3.3.6. Dorsal Acetabular Edge Radiography

This technique, defined by Slocum, is used to evaluate the integrity and slope of the dorsal acetabular rim. In this technique, dogs are placed in the sternal position and both hind legs are pulled forward. The weight-bearing part of the acetabulum is examined on the radiography. In dogs with normal hips, the angle between the line tangent to the lateral angle of the dorsal acetabular edge and the line drawn perpendicular to the long axis of the pelvis should be 7.5º or less. Dorsal acetabular rim angle of 20 or more indicates that the dog

is dysplasia (Karabaglı et al. 2014, Slocum et al. 1990, Slocum et al. 1998, Tatlı 2012).

4. TREATMENT OF HIP DYSPLASIA

When determining the method to be applied for the treatment of hip dysplasia, the age of the patient, the severity of the clinical findings and the severity of the radiographic findings are important criteria.

4.1. Medical Treatment

Medical treatment methods are used in patients with hip dysplasia to alleviate the clinical symptoms that cause pain, to increase the quality of life and to regress the disease (Dassler 2002, Karabaglı et al. 2014).

Non-steroidal anti-inflammatory drugs are used to relieve the pain caused by clinical symptoms. For this purpose, caprofen at a dose of 2.2-4.4 mg / kg or etodolac at a dose of 10-15 mg / kg is administered to dogs via peros. Cold and warm compresses can be applied to the painful area (Dassler 2002, Karabaglı et al. 2014).

Drugs containing glycosaminoglycan or chondritin sulfate used in joint disorders are used in hip dysplasia cases due to their prevention of joint degeneration and their chondroblastic activities (Karabaglı et al. 2014, McNamara et al. 1997).

Nutrition and weight control, exercise and physical therapy are the methods used in the medical treatment of hip dysplasia. Nutrition and rapid weight gain are the most important preliminary reasons for the development of hip dysplasia. Therefore, it is recommended that

young dogs be fed with a balanced diet containing high quality protein instead of ad-libitum feeding with high energy diet programs. In one study, it was reported that the risk of hip dysplasia in dogs fed ad-libitum was higher than in dogs with a restricted diet (Karabaglı et al. 2014, Kealy et al.1992).

Exercise and physical therapy practices reduce the symptoms of osteoarthritis caused by hip dysplasia. Treatment options such as electrotherapy, massage applications, diathermy, and acupuncture reduce the severity of the clinical symptoms of hip dysplasia (Karabaglı 2014).

4.2. Surgical Treatment Options

4.2.1. Juvenile Pubic Symphysiodesis (JPS)

JPS is a prophylactic surgical method in dogs with a risk of hip dysplasia in non-adult age (Karabaglı et al. 2014, Özdemir et al. 2006, Schulz et al. 2003). With this method, the circular growth of the pelvic canal is limited by burning the growth plates in the symphizis pelvina. Bilateral rotation of the acetabulums occurs, increasing the adaptation of the femoral heads to the acetabulum (Figure 9). Studies have shown that the most appropriate age for the application of the JPS technique is 12-18 weeks. Dueland et al. reported that the JPS technique can also be used in puppies at the age of 24 weeks, but the chances of success are low due to the completion of the development of the skeletal system (Dueland et al. 2001, Dueland et al. 2002, Karabaglı et al. 2014, Özdemir et al. 2006, Schulz et al. 2003).

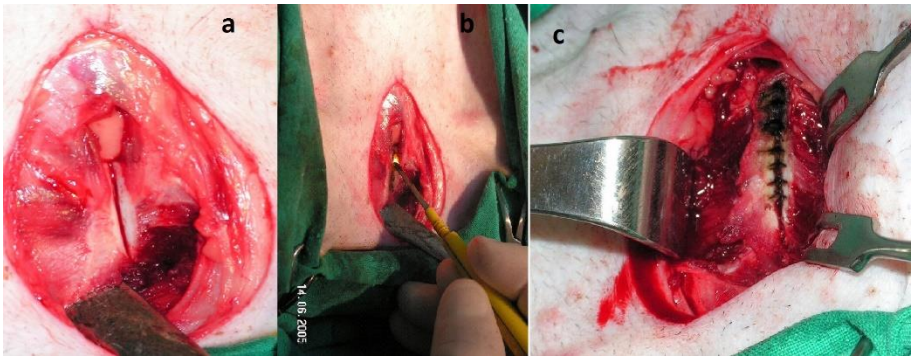

Figure 9: Stages of JPS operation: surgical approach to the operation site (a), burning of the growth plates in the symphysis pelvina with cautery (b), the appearance of the symphizis pelvina area after cauterization (c) (Özdemir et al. 2006).

4.2.2. Excision Arthroplasty

Excision arthroplasty is an operation technique indicated in cases such as hip dysplasia, Legg-Calve-Perthes disease, femoral head fractures. With excision arthroplasty, caput ossis femoris and collum femoris osteotomy is performed, and a functional recovery is achieved in the joint (Figure 10). In excision arthroplasty, a painless and functional pseudo joint is created by eliminating the pathological hip joint. Although the importance of the physical structure of dogs in the success of this technique is not fully proven, it is known that the success rate is higher in small breed dogs (Dassler 2002, İki and Saglam 2004, Güzel and Altunatmaz 2006, Karabaglı 2014, Raghuvir et al. 2013).

Excision arthroplasty technique is preferred in advanced hip dysplasia where the anatomical structure of the acetabulum and femoral head is impaired (Dassler 2002, İki and Saglam 2004, Güzel and Altunatmaz 2006, Karabaglı 2014, Raghuvir et al. 2013).

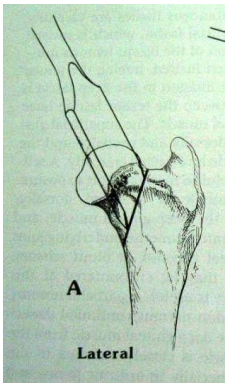

Figure 10: The area to be removed from the femur in excision arthroplasty applications (Bilgili 2017)

4.2.3. Triple Pelvic Osteotomy (TPO)

TPO is indicated in cases of hip dysplasia that are detected in the early period and do not cause degenerative changes in the joint. TPO is a contraindicated technique if the inside of the acetabulum becomes plump and shallow and the femoral head has lost its anatomical structure (Dassler 2002, Güzel and Altunatmaz 2006, Karabaglı 2014).

According to this technique, after osteotomy is performed on the pubis, ischii and ilium bones, respectively, with the help of plates with 20º and 40º degrees, the acetabulum is tried to cover the femoral head

and to reduce joint laxity (Figure 11) (Dassler 2002, Deny and Butterworth 2000, Güzel and Altunatmaz 2006, Karabaglı 2014,).

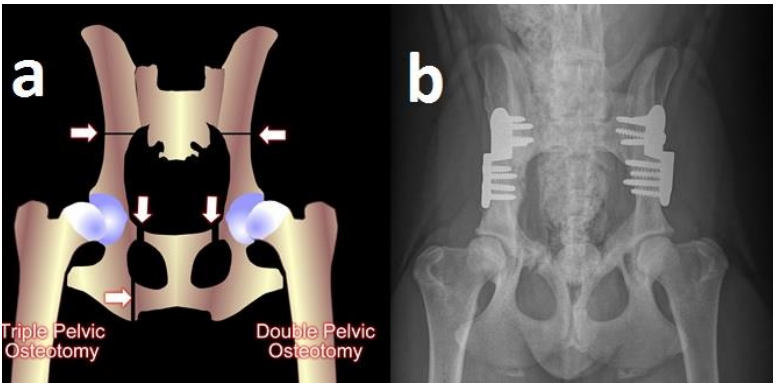

Figure 11: During TPO application, osteotomized areas (a), post-application radiographic image (b) (Anonim (e) 2020)

4.2.4. Intertorachenteric Osteotomy (ITO)

ITO is one of the prophylactic surgical procedures used to prevent progression of hip dysplasia. This operation is performed to correct the femoral inclination angle. The femoral inclination angle is the angle between the femoral neck and the long axis of the femur. This angle is approximately 145 ° in healthy dogs. Femoral inclination angle increases 30º-35º in dogs with hip dysplasia. In the ITO technique, a wedge-shaped osteotomy is made between the trochanter major and the trochanter minor. Then the osteotomy area is fixed with the help of orthopedic materials such as plates and the femoral head is placed in the acetabulum to increase joint stability (Figure 12) (Alexander 1992, Güzel and Altunatmaz 2006, Karabaglı et al. 2014, Moses 2000, Piermattei and Flo 1997, Pinna et al. 2013, Raghuvir et al. 2013).

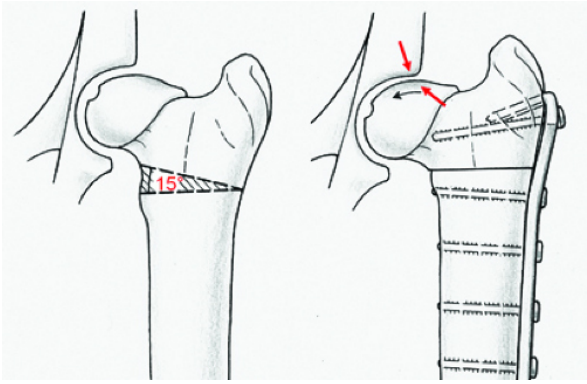

Figure 12: Application of ITO technique (Ecker et al. 2020)

4.2.5. Darthoplasty

In the darthoplasty technique, bone graft is first taken from the free end of the ilium bone. The graft taken is moved to the dorsal edge of the acetabulum and the acetabulum is deepened. Thus, the joint is stabilized by enabling the acetabulum to grip the femoral head more. Dartoplasty can be performed in cases where degenerative changes in the joint surface are less. (Derincegöz 2011, Güzel and Altunatmaz 2006, Moses 2000, Yaprakcı and Kaya 2014).

4.2.6. Myectomy of the Musculus Pectineus

With the musculus pectineus myectomy, it is aimed to increase the contact surface of the acetabulum with the femoral head by releasing the adductor muscles. Thus, the tension of the joint cartilage is also reduced (Derincegöz 2011).

4.2.7. Total Hip Replacement

Total hip replacement is a surgical technique used in cases where the hip joint mobility is reduced or completely lost. If the acetabulum and femoral head lose their normal anatomical structure, total hip replacement is indicated. Except for hip dysplasia, total hip replacement is indicated in diseases with impaired joint structure such as fractures of the femoral head, coxaeartrosis, Legg-Calve-Perthes disease (Güzel and Altunatmaz 2006, Karabaglı et al. 2014, Olmstead et al. 1983).

Total hip replacement begins with the process of fixing the polyethylene cup with polymethylmethacrylate cement instead of dysplastic acetabulum. The process is then completed by placing the stainless steel femoral head and shaft (Figure 13) (Güzel and Altunatmaz 2006, Karabaglı et al. 2014, Olmstead et al. 1983).

Generally, even if hip dysplasia is bilateral, total hip replacement is performed unilaterally. Since the prosthetic side reduces the load on the other side, it is not applied to both hips at the same time (Derincegöz 2011, Karabaglı et al. 2014).

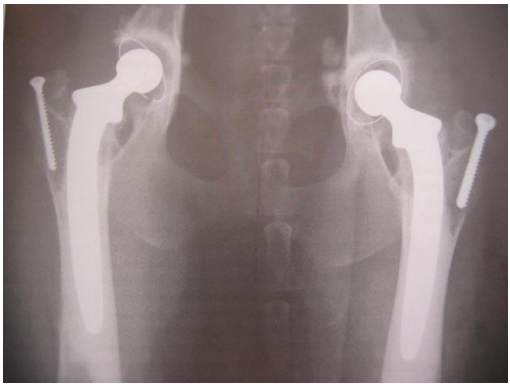

Figure 13: Hip radiography of a dog with a total hip replacement (Bilgili 2017).

5. CONCLUSION

Hip dysplasia is one of the most common orthopedic problems in dogs. Hip dysplasia, a multifactorial disease, is a polygenic hereditary disease. Although the genetics of dogs are an important cause of the disease, environmental factors are very effective on the disease. For this reason, it is necessary to be careful in feeding, caring and exercise programs of dogs with genetic predisposition. Foods containing quality protein should be preferred instead of high energy foods. Exercise programs should not be heavy.

Hip dysplasia is a progressive disease. For this reason, the period when the disease is diagnosed is important in determining the treatment option. Treatment options such as JPS, TPO, ITO, and dartoplasty are the techniques used in cases diagnosed at an early stage. It is applied to prevent severe degenerative changes that may occur in the hip joint as a result of the progression of the disease. However, treatment options such as THR and excision arthroplasty are

used in the treatment of severe dysplasia cases with degenerative changes in the joints.

To eradicate hip dysplasia, puppies should be taken after the pedigrees of the breeded dogs have been evaluated. Dogs with suspected hip dysplasia should be removed from production. There are some organizations and organizations around the world to evaluate and follow up cases of hip dysplasia in dogs. Organizations such as OFA, FCI and BVA / KC identify dogs at risk of hip dysplasia using assessment systems and keep pedigree records.

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CHAPTER 4

MEDICAL USES OF AVIAN EGG IN PRENATAL STRESS MODELS

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5.Uluslararası Zeugma Bilimsel Araştırmalar Kongresinde Abstract olarak yayımlanmıştır.

INTRODUCTION

Stress, defined by Hans Selye as the nonspecific response of the body to any demand (Selye, 1976; Marketon and Glaser, 2008) today, constitutes one of the biggest problems of the 21st century. The hypothalamopituitary adrenal axis (HPA) is activated against stress (Wosu, 2013). Moreover, with the activation of the sympathoadrenomedullar axis (SAM), the synthesis of adrenaline and noradrenaline occurs and the body provides the fight or flight response to stress (Staufenbiel et al., 2013). With the activation of HPA, corticotropin-releasing factor (CRH) is released from the paraventricular nucleus in the hypothalamus, and the adrenocorticotropin hormone (ACTH) is released from the hypophisis (Finsterwald and Alberini, 2014). This hormone secretes cortisol from the zona fasciculate layer of the cortex of the adrenal gland (Turcu et al., 2015). Cortisol is a hormone that controls its release through feedback (Turpeinen et al., 2013).

In short-term adaptation to acute stress (Goel et al., 2014) cortisol affects the coordinated action of brain and body functions in coping with stress (De Kloet et al., 2005). As an adaptive response to the maintenance of homeostasis in the body, heart rate is increased with the release of cortisol, blood glucose metabolism are stimulated (Van Aken et al., 2018).

Stress becomes chronic, triggering negative effects on HPA and on health (McEwen and Seeman, 1999). Because both physical and psychological stress are the factors that cause HPA axis hyperactivity

(Wester and Van Rossum, 2015). There are studies showing that there is a relationship between changes in the activity of the HPA axis and mental health and is one of the important causes of panic disorder (De Kloet et al., 2005).

1. PRENATAL STRESS

Considering the diseases and triggered groups of symptoms caused by stress, it is a matter of interest for scientists to investigate what can be revealed during the emergence of the future of human beings, which is a physiological process. Therefore, it is important to examine the changes in prenatal stress and cortisol and to model these effects. In this context, sufficient information could not be provided to begin the investigation of the underlying causes of prenatal stress in the mid-1950s (Levine and Mullins, 1958; Lay Jr and Wilson, 2002). Scientists were divided to suggest the effects of maternal endorphins on the fetus in explaining the basic source of prenatal stress mechanism (Weinstock, 1996; Lay Jr and Wilson, 2002).

In a study conducted in this context; In the last trimester of pregnancy, cortisol level increased approximately three times (Ericson et al., 2001; Sandman et al., 2006; Kirschbaum et al., 2009; D'Anna-Hernandez et al., 2011) and the source of this increase was found to be corticotropin hormone of placental origin. It has been suggested that both increased cortisol following awakening and increases in diurnal cortisol levels are associated with preterm birth in women with decreased birth weight and with increased fetal activity (Kirschbaum et al., 2009; Field and Diego, 2008; Christian et al., 2013; Schreier et

al., 2015) and with miscarriages (Nepomnaschy et al., 2006). The increase in maternal cortisol level triggers negative effects on offspring's HPA axis and rearranges it (Guttelinget al., 2005; Van den Bergh et al., 2008; D'Anna-Hernandezet al., 2011).

In this period, intense prenatal stress, including anxiety and depression, causes negative effects on the mother's mental state and pregnancy outcomes, and adverse effects on fetal development on the newborn (Kalra et al., 2007) in the subsequent period (Braig et al., 2016).

It has been observed that stress experienced during prenatal period causes behavioral and physiological changes on the fetus (Lay Jr and Wilson, 2002), and it has led to the development of animal models to solve physical and mental health problems in children due to the stress perception (Henriksenet al., 2013).

2. ANIMAL MODELS TO STUDY PRENATAL STRESS

Although there are many animal models (Kalra et al., 2007), such as the use of rhesus monkeys, rodents have been the most preferred animals (Abdul-Ghani et al., 2012). However, mammals have various methodological deficiencies (Abdul-Ghani et al., 2012).

By completing the growth and developmental process of the fetus in the uterus, the fetus can be affected by maternal hormonal changes due to the feeding of the baby through the placenta, and the maternal nutritional change can also trigger hormonal changes and affect the offspring (Willems et al., 2015). Considering the complex interactions

between mother-fetus and environment, the inadequacy of mammalian animal models in revealing the mechanism of the disease is the prominent deficiencies in mammalian models (Tzschentke et al., 2015).

3. AVIAN EGG MODELS TO STUDY PRENATAL STRESS

Avian species that complete their embryonic development independently of the mother are excellent models to study both prenatal and perinatal development and (Davey and Tickle, 2007), as their 21-day incubation stages are well known, they allow manipulation in the desired time period (Tzschentke et al., 2015). Records based on Aristotle and Hippocrates show that both Japanese quail (Coturnix coturnix) and chickens (Gallus gallus domesticus) have a scientific history of 1000 years in embryological studies (Flentke and Smith, 2018).

The fact that avian and mammalian physiology has some similarities has made this model the preferred reason for revealing prenatal stress. While the embryo develops in extra-embryonic membranes inside the egg in poultry, there are extra embryonic membranes that shape the placenta and umbilical cord in mammals (Von Engelhardt et al., 2009). These two membranes are similar in both the removal of metabolic wastes and the point of providing gas and water exchange (Von Engelhardt et al., 2009).

The development of the offspring in the egg independent from the mother and the placental effect makes the egg a good animal model at the point of revealing the effects of hypoxia that may occur during embryonic and fetal development (Rodricks et al., 2008).

Body weight regulation and food consumption is mediated by Nucleus arcuatus hypotalami in the hypothalamus in the mammals (Woods et al., 2000) while in chickens its counterpart is nucleus infundubuli hypothalamus (Kuenzel and Masson, 1988). However, neuroendocrinological regulation of energy balance is quite similar (Shiraishi et al., 2008). Endocriologically, the development of mammals, humans and chickens is very similar to each other (De Groef et al., 2008), this model allows to study obesity (Cassy et al., 2004) and diabetes (Yoshiyama et al., 2005).

Evaluation of the activity of the HPA axis in poultry is performed by measuring corticosterone (Bortolotti et al., 2008). In fact, corticosterone is the equivalent of cortisol in mammals. Avians are a unique model for investigating the effects of stressors that may occur during prenatal period on childhood and adult behavior (Dennis et al., 2013).

Both the ease of manipulation and the fact that albumin is the main nutrient of the developing embryo make the egg valuable in such studies (Willems et al., 2015). Because, by adding salt instead of albumin in the early embryonal period, the effects of protein deficiency can be revealed independently of the maternal effect (Willems et al., 2015).

Studies have shown that malnutrition during times of famine triggers permanent changes on insulin-glucose metabolism, and there is a relationship between type 2 diabetes and children born with low birth weight (Ravelli et al., 1998; Willems et al., 2016). The insulin-glucose metabolism, which is impaired due to malnutrition, provides it metabolic adaptation to survive, but if the fetus comes across with enough or too much food in the postnatal period, it is exposed to prenatal and postnatal metabolic programming conflict, resulting in diseases and dysfunction (Willems et al., 2016).

In addition, avians are used as prenatal models to provide behavioral modeling in studies aimed at evaluating the precise time of memory formation (Gibbs and Ng, 1979).

It is also preferred in terms of revealing the teratogenic effects of chemicals that can trigger stress (Abdul-Ghani et al., 2012) or for finding out the addictive effects nicotine (Levitt, 1998), alcohol (Rice and Barone, 2000) and cocaine (Larson et al., 2001) on neuronal development during prenatal period.

CONCLUSION

Pregnancy is a physiological and complex process. As a result of both physical and emotional stressors experienced during this period, the pregnancy process is endangered and creates negative effects on the fetus. In this context, elucidating the mechanism of prenatal stress and revealing its effects are important for both mother and fetus. In order to have healthy generations and to create healthy societies, it seems that avians are unique models in which the effects of prenatal stress can be evaluated independently of the mother. Therefore their medical use is also important.

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CHAPTER 5

REORGANIZING THE CAPITAL STRUCTURE OF BEEKEEPING ENTERPRISES

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INTRODUCTION

Beekeeping has a significant place in agriculture. It is a critical source of revenue, especially for the communities living in rural areas. The period of return on investment of beekeeping is short and it is high in amount. Besides, the need of the initial and operation capital is low. Thanks to the effects of beekeeping on pollination, there will be significant contributions to the sustainability of environment and high nutrient density of food, and also it will have positive impacts to the potential of using it in alternative medicine practices and to benefit from unused agricultural fields. Beekeeping is among the livestock activities that are affected the most by weather conditions since it is directly connected to the nature.

Malnutrition is one of the biggest problems especially in the developing and the underdeveloped countries. The rapid boost in the world population increases the seriousness of the issue. Beekeeping is an agricultural activity that is considered significant in the developed and the developing countries. The strong features standing beekeeping out are that it is not directly dependent on soil, it can be done with a small capital and the need for labor is not that high compared to other agricultural activities (Erkan and Askın, 2001).

Beekeeping, which is defined as the art of using plant, bee, and labor together, is one of the important agricultural production branches in developed and developing countries (Gencer and Karacaoglu, 1999). Compared to other production sectors, thanks to its lower initial

investment costs and less need of labor, beekeeping provides employment and healthy nutrition opportunities in developing rural areas (Uzundumlu, Aksoy, and Isık, 2011). In addition to these benefits, due to other remarkable benefits of beekeeping such as requiring a small capital, quick return of investment and no dependence on field, the beekeeping is a preferred activity among other agricultural production activities (Burucu and Bal, 2017). First, the beekeeping activities focused on meeting the need of honey consumption, then it became a source of income and an essential agricultural activity in our country (Akpınar, Ozsan, and Tascı, 2012). Beekeeping has grown rapidly in recent years due to the fact that it is an income opportunity for the landless or small farmers, and the beekeeping products provide good income (Sahinler and Sahinler, 1996).

The levels of record-keeping and accounting for financial operations and activities of beekeeping enterprises within the production period are low. Therefore, these enterprises do not have sufficient data regarding business administration and cannot make healthy decisions. Encouraging beekeepers to keep business records will contribute to obtain the right data and eventually to make healthy decisions. So, it is essential to determine the capital structure of the enterprises when keeping the accounting records.

This study has been prepared using the dissertation named "Determining the Impact of IPARD Supports on the Beekeeping Enterprises: Example of Van Province".

1. MATERIAL AND METHOD

Main material of the research was the data collected from beekeeping enterprises receiving IPARD I program support in Van province through questionnaires. publications and web sites of relative public institutions in the research area and Ministries of Agriculture of Turkey and EU countries, Turkish Statistical Institute (TSI), the Food and Agriculture Organization (FAO), the World Bank (WB), European Union Statistical Institute (EuroStat), and previous research findings and published secondary data were used.

Van province has been selected as the research area in terms of "Telic Sampling Method". Having nearly 3% of honey production in Turkey (TSI, 2018), and 4% of total beehives, Van province, is one of the top three provinces receiving the largest beekeeping support from IPARD I. Within the scope of the IPARD program, when the provinces benefiting from beehive and machinery and equipment supports under the sub-measure 302-1 are ranked, the province of Ordu is the first with the highest number of 97,213 beehives, while Van is the second with 32,600 beehives. Following these two provinces, Mardin is the third one with 20,622 beehives. Research was conducted in beekeeping enterprises supported by IPARD. There are 94 beekeeping enterprises supported by IPARD in Van. Primary data (the number of beehives of the enterprises) are listed from small to large, and the coefficient of variation is used to determine whether the population is homogeneous or not.

$$C.V = \frac{S}{\bar{X}} 100$$

In the formula:

C.V = Coefficient of Variation

S = Standard Deviation,

X = Average

This coefficient is a percentage value and is calculated by dividing the standard deviation to the average value (Cicek and Erkan, 1996; Oguz and Karakayacı, 2017). Coefficient of variation is important in terms of determining whether values of units belonging to a population or sample are homogeneous or heterogeneous. In addition, it is accepted as suspicious since a sample with a coefficient of variation above 33% represents a normal population. (Duzgunes, Kesici, and Gurbuz, 1983). In this study, coefficient of variation (C.V) is calculated as 74%. Therefore, the stratified sampling method has been used to increase the accuracy of the data collected from the enterprises and to ensure that the different sections in the population can be adequately represented in the study (Günes and Arikan, 1988).

The basic foundation of this method is to determine one sample volume considering the average of each strata and the weights of its variations (Cicek and Erkan, 1996; Oguz and Karakayaci, 2017). In enterprises, when there are important differences between stratas in terms of volume and variation, Neyman Method is used to increase efficiency of the sampling. According to Neyman Method, the

equation formula used to determine sample volume as follows (Karagolge and Peker, 2002; Yamane, 1967):

$$n = \frac{[\sum(N_h S_h)]^2}{N^2 D^2 + \sum[N_h (S_h)^2]}$$

In the formula;

n = Sample volume

N = Total number of units

S_h = Standard deviation of strata h

N_h = Unit number of strata h (frequency)

Z = Z value in the standard normal distribution table

D = d / Z

d = Error term of sample

The sizes of enterprises have been researched based on 3 stratas and considering the frequency distributions, it is determined to create 3 stratas. Limits of these stratas are determined as enterprises with 0-100 beehives (Strata 1), 101-250 beehives (Strata 2) and 251+ (Strata 3) beehives. As a result, 17 of 94 enterprises is in 101-250 Strata, and 22 of them are in the Strata 2 and 55 of them are in the Strata 3.

Undoubtedly, the required data for planning the agricultural enterprise and their economic analysis can be obtained from the accounting records correctly. However, the agricultural enterprises in Turkey usually do not keep accounting records. So, it is mandatory to benefit from the data to be obtained from the surveys done among the

agricultural enterprises and from the results of available researches (Erkus, Demirci, Ozcelik, and Bahattin, 1987).

The questionnaire forms were prepared in accordance with the objectives of the research, considering the characteristics of the beekeeping enterprises in the scope of research area. Questionnaire forms were populated by the researcher.

In the research field, the enterprises have been classified and evaluated depending on the capital structure liquidity. While the active capital is classified into three categories (working in itself assets, medium-term assets and fixed assets) according to its convertibility into cash, the passive capital has two categories as equity capital and debts. Considering debt dues, debts are also categorized into three categories: long (current), medium- and short-term debts. In term of the analysis of capital, it is found more suitable to classify the capital based on its liquidity (Erkus, Bulbul, Kıral, Acıl, and Demirci, 1995). In this research, the capital has been classified considering the liquidity of capital and the features of beekeeping enterprises.

2. RESEARCH FINDINGS AND DISCUSSION

2.1. Capital Structure in Enterprises

Depending on its convertibility into cash, active capital is classified into three categories: working in itself assets (current or short-term assets), medium-term assets and real (fixed or long-term) assets. The passive capital is categorized into two groups as equity capital and

debts. Considering their periods, debts are also categorized into three groups: short-term (current) debts, medium-term debts and long-term debts. In terms of the analysis of capital, it is found more suitable to classify the capital depending on its liquidity (Oğuz and Bayramoglu, 2015). In this research, the classification of the enterprises depending on their capital's liquidity has been adapted to beekeeping enterprises.

A. ACTIVE CAPITAL

1. Working (Current) Assets
   a. Financial Asset
   b. Receivable Asset
   c. Material and Supplies Asset
   d. Main Product Kept in Stock Asset
   e. Byproduct Kept in Stock Asset
   f. Cluster to be Sold Asset
2. Medium-term Assets
   a. Colony Asset
   b. Tool-Machinery Asset
3. Real (Fixed) Assets
   a. Beehive Asset
   b. Shelter Asset
   c. Vehicle Asset

B. PASSIVE CAPITAL

1. Debts (Foreign Capital)
   a. Short-term (Current) Debts (1-year maturity)

b. Medium-term Debts (1 / 5-year maturity)

c. Long-term Debts (More than 5-year maturity)

2. Equity Capital

2.2. Active Capital

Active capital is classified into three groups: working in itself assets (current or short-term assets), medium-term assets and real (fixed or long-term) assets.

2.2.1. Working (Current) assets

The difference of working assets from the other capitals is that their amount decreases when used or they transform into another capital within the enterprise (Erkuş et al., 1995).

2.2.1.1. Financial Asset

For the sustainability and success of enterprises' production activities, it is needed to have a material and supplies capital, as well as ready-to-use and enough money capital. This amount depends on various factors such as the size of enterprise, business organization and production pattern. The money capital of the enterprises consisting of the current money asset and receivables can easily convert into other types of capital due to its high liquidity as a medium of exchange (Bulbul, 1973). Money capital is the most dynamic capital group in the active capital. In other words, it is the one with the highest liquidity. Having enough of this capital which is rather effective on the continuity of enterprise's activity is essential for the enterprise to

perform its operations successfully (Erkus, 1979). The current money capital of the enterprises examined consists of the receivables of the enterprise and the cash money available within that enterprise. The statement of the enterprise owner is taken as a basis to manifest the money capital of the enterprises and to determine the debts and receivables.

2.2.1.2. Receivable Asset

Receivable asset is the cash amount that the enterprise expects to return in exchange for its sales or in other ways. The statement of the enterprise owner is taken as a basis to determine the debts and receivables.

2.2.1.3. Material and Supplies Asset

Another capital group within the working assets is the material and supplies capital. Material and supplies capital comprises of the total value of feed, seed, fertilizer, food, heating, cleaning supplies, and the products set aside to be sold or in stock (Fidan, 1997; Gunes, 2004). Auxiliary materials (materials and equipment) have been evaluated depending on their purchase price for the ones supplied outside of the enterprise and depending on their farmyard prices for the ones produced in the enterprise (Erkus, 1979).

2.2.1.4. Main Product Kept in Stock Asset

The value of main product in stock is the monetary value of the product amount that is ready for sale and kept in stock after the production period.

2.2.1.5. Byproduct Kept in Stock Asset

The value of byproduct in stock is the monetary value of the product amount that is ready for sale and kept in stock after the production period.

2.2.1.6. Cluster to be Sold Asset

Cluster to be sold asset is the monetary value of the cluster amount that the enterprise obtained by splitting or in a natural way during a production period.

Table 1: Working (Current) Assets in the Examined Enterprises

	Enterprises Size Groups (Colony)							
	0-100		101-250		251-+		Entr. Avg.	
	TL	%	TL	%	TL	%	TL	%
Financial Asset	1,764.71	16.1	2,500.00	8.86	1,607.27	2.48	1,844.68	3.96
Receivable Asset	2,970.59	27.2	8,204.55	29.1	18,327.27	28.2	13,180.85	28.3
Material and Supplies Asset	3,444.85	31.5	9,036.08	32	21,651.09	33.4	15,406.02	33.1
Main Product Kept in Stock Asset	314.71	2.88	1,240.91	4.4	2,782.73	4.29	1,975.53	4.24
Byproduct Kept in Stock Asset	0	0	0	0	0	0	0	0
Cluster to be Sold Asset	2,439.71	22.3	7,222.73	25.6	20,529.09	31.6	14,143.35	30.4
TOTAL	10,934.56	100	28,204.26	100	64,897.45	100	46,550.44	100

2.2.2. Medium-term Assets

Medium-term assets are the colony asset comprising the essential productive capital, plus the inanimate inventory called the tool and machinery asset.

2.2.2.1. Colony Asset

Colony asset is the live animals of the beekeeping enterprise that are kept producing honey and other byproducts, and also to use for pollination contribution for more than one year. The purchase and sale

value of the bee colonies within the region depending on their age and productivity, and the statement of the enterprise owner is taken as a basis to determine the colony capital. The colony capital is 10,305.88 TL in the enterprises with 0-100 colony asset; it is 27,476.36 TL in the enterprises with 101-250 colonies; and it is 67,316.36 TL in the enterprises with 251-+ colonies. The colony asset and capital of the examined enterprises is described in Table 2.

Table 2: Colony Asset and Bee Capital of the Examined Enterprises

Enterprises Size Groups (Colony)	Colony (Piece)	Bee Capital (TL)
0-100	64.41	10,305.88
101-250	171.73	27,476.36
251- +	420.73	67,316.36
Entr. Avg.	298.01	47,681.70

2.2.2.2. Tool and Machinery Asset

The tool and machinery capital impacts the productivity indirectly by affecting the herbal and animal production. The total value of various tools and machines that are used in agricultural production comprises the tool and machinery capital. In the agricultural enterprises, the tools and machines used to make the capital of farm more productive substitute the labor in some production lines (Gunes, 2004). Evaluating the tool-machinery capital, the purchase prices of the new ones and the current purchase and sale values of the old ones have been taken into account (Bulbul, 1973). The most important factor determining the size and type of machinery and tool investments is the

requirement of enterprise and production activities. The increase of the enterprise's production capacity is directly proportional to the increase in the tool-machinery capital. The tool-machinery capital is 1,125.71 TL in the enterprises with 0-100 colony asset; it is 3,362.77 TL in the enterprises with 101-250 colonies; and it is 4,461.53 TL in the enterprises with 251-+ colonies. The colony asset and capital of the examined enterprises is described in Table 3.

Table 3: Tool-Machinery Capital in the Examined Enterprises (TL)

	Enterprises Size Groups (Colony)							
	0-100		101-250		251- +		Entr. Avg.	
	TL	%	TL	%	TL	%	TL	%
Nucleus beehive (Queen breeding)	0	0	0	0	640	14.34	374.47	10.4
Mating Box	10.59	0.94	81.82	2.43	469.64	10.53	295.85	8.22
Honey settling tank	141.18	12.54	136.36	4.05	338.18	7.58	255.32	7.09
Honey moisture meter/Field glasses	0	0	5.91	0.18	0	0	1.38	0.04
Filtration machine	41.18	3.66	636.36	18.92	763.64	17.12	603.19	16.75
Bar drilling machine	23.53	2.09	61.82	1.84	50.91	1.14	48.51	1.35
Beekeeper Brush	22.59	2.01	35.64	1.06	37.82	0.85	34.55	0.96
Beekeeper Smoker	27.35	2.43	40.91	1.22	54.82	1.23	46.6	1.29
Beekeeper's spur (plastic)	10.82	0.96	16.36	0.49	17.75	0.4	16.17	0.45
Beekeeper mask	80.29	7.13	147.95	4.4	220.18	4.94	177.98	4.94
Queen excluder	26.47	2.35	125.91	3.74	404.18	9.06	270.74	7.52
Queen cage	1.24	0.11	57.27	1.7	139.49	3.13	95.24	2.64
Glove	28.24	2.51	39.55	1.18	57.27	1.28	47.87	1.33
Honeycomb	9.88	0.88	11.45	0.34	25.2	0.56	19.21	0.53
Uncapping vessel/basin	70.59	6.27	245.45	7.3	349.09	7.82	274.47	7.62
Uncapping Knife	12.35	1.1	16.36	0.49	19.09	0.43	17.23	0.48
Wasp trap	0	0	17.05	0.51	0.45	0.01	4.26	0.12

Pollen trap	476.47	42.33	1,353.41	40.25	549.55	12.32	724.47	20.12
Pollen drying closet	141.18	12.54	327.27	9.73	283.64	6.36	268.09	7.44
Pollen cleaning machine	0	0	0	0	21.82	0.49	12.77	0.35
Larvae transfer ladle	1.18	0.1	1.36	0.04	3.09	0.07	2.34	0.06
Queen transfer bar	0.59	0.05	4.55	0.14	6.64	0.15	5.05	0.14
Artificial insemination kit	0	0	0	0	9.09	0.2	5.32	0.15
TOTAL	1,125.71	100	3,362.77	100	4,461.53	100	3,601.09	100

2.2.3. Real Fixed Assets

Real (fixed) assets consist of beehive asset, shelter asset and vehicle asset.

2.2.3.1. Beehive Asset

Beehive asset is the monetary value of the beehives belonging to enterprises regardless of their usage in production. The beehive capital is 26,382.60 TL in the enterprises with 0-100 colony asset; it is 28,527.60 TL in the enterprises with 101-250 colonies; and it is 27,730.80 TL in the enterprises with 251-+ colonies. The capital average of the examined enterprises is 27,673.46 TL. The reason that the beehive capital of enterprises is so close in contrast to the size of enterprises, that is the colony asset capital is that the number of beehives the enterprises obtained thanks to the supports are similar to each other but the occupancy rate of the beehives are different.

2.2.3.2. Shelter Asset

Shelter asset is the monetary value of the beekeeper's tent and beekeeper's shelter that the enterprises use during production stage. Shelter asset includes the monetary amount of the beekeeper's tent and beekeeper's shelter. The shelter capital is 1,125.71 TL in the enterprises with 0-100 colony asset; it is 3,362.77 TL in the enterprises with 101-250 colonies; and it is 6,734.25 TL in the enterprises with 251-+ colonies. The average of the examined enterprises is 4,930.87 TL.

2.2.3.3. Vehicle Asset

Vehicle asset is the monetary value of the vehicles that belongs to the enterprises and that they use during production. The vehicle capital is 0.00 TL in the enterprises with 0-100 colony asset; it is 0.00 TL in the enterprises with 101-250 colonies; and it is 2,272.73 TL in the enterprises with 251-+ colonies. The average of the examined enterprises is 1,329.79 TL. The beehive, shelter and vehicle asset of enterprises are described in Table 4.

Table 4: Real Assets by Enterprise Groups

Capital Groups	Enterprises Size Groups (Colony)							
	0-100		101-250		251-+		Entr. Avg.	
	TL	%	TL	%	TL	%	TL	%
Beehive Asset	26,382.60	95.9	28,527.60	89.5	27,730.80	75.5	27,673.46	81.6
Shelter Asset	1,125.71	4.09	3,362.77	10.5	6,734.25	18.3	4,930.87	14.5
Vehicle Asset	0	0	0	0	2,272.73	6.19	1,329.79	3.92
Total	27,508.31	100	31,890.37	100	36,737.78	100	33,934.12	100

2.3. Passive Capital

The passive capital amount of the examined enterprises comprises of the equity and foreign capital used in the enterprises. The passive capital is the total sum of foreign capital and the equity capital. The structure of the passive capital gives information about the structure of enterprise.

2.3.1. Debts (Foreign Capital

In agricultural enterprises, passive capital shows the resources of active capital. The active assets are provided from two resources: equities and liabilities. If the liabilities, meaning debts are excluded from the total active capital, the rest will be equities, that is the equity capital (Erkus et al., 1995). Debts are classified in three categories depending on their dues. The debts to be paid within a year, and the medium and long-term debts' installments to be paid within the

current year are the short-term (current) debts (Erkus et al., 1995). The statement of the enterprise owner is taken as a basis to manifest the money capital of the enterprises and to determine the debts and receivables.

a) Short-term (current) debts
Short-term debts are the debts with less than 1-year maturity.

b) Medium-term debts
Medium-term debts are the debts with 1 to 5-year maturity.

c) Long-term debts
Long-term debts are the debts with more than 5-year maturity.

2.3.2. Equity Capital

Equity capital is the value of enterprise owners' individual shares of the total assets. This indicator, which is also called equity capital or equity, is equal to the difference between total assets (active total) and the total debts. The assets of an enterprise can be financed with two types of resource: liabilities and equity. Liabilities are short or medium and long-term debts provided from organizations or individuals other than the enterprise owners, that is outsourced. Equity is the resource that the enterprise owners procured by their own efforts and that they set apart from their own money. So equity indicates the financial share of enterprise owners within the enterprise or the size of the risk they have related to the enterprise (Acar, 2003). In the research, equity has been found by deducting the debts from the active.

Table 5: The Distribution of Passive Capital in the Examined Enterprises

Capital Groups		Enterprises Size Groups (Colony)			
		0-100	101-250	251-+	Entr. Avg.
1. Debts (Foreign Capital)	Short-term (Current) Debts	0	0	0	0
	Medium-term Debts	12,195.29	18,909.09	6,023.64	10,155.53
	Long-term Debts	2,058.82	0	372.34	590.2
	Total	14,254.12	18,909.09	6,395.98	10,745.73
2. Equity Capital	Equity Capital	35,620.34	72,024.68	167,017.15	121,021.62
Total Passive Capital		49,874.46	90,933.77	173,413.13	131,767.35

The 48,94% of examined beekeeping enterprises use bank loan. The enterprises used 10,745.73-TL loan on average per year. The enterprises which supply their loan from the banks mostly chose Bank of Ziraat (76,1%), followed by consumer loans from private banks (17.4%), and Agriculture and Credit Cooperatives (6,5%). In the study performed by Emir across Turkey, this rate is 51%, which is similar to this study (Emir, 2015); however, the studies conducted by Yasar et al. and Yalcın showed that a smaller amount of loan (21%) used by beekeeping enterprises (Yalcın, 2014; Yasar, Güler, Yesiltas, Bulut, and Gokce, 2002). The distribution of active and passive capital of the enterprises within the scope of research is shown on Table 6.

Table 6: The Distribution of Active and Passive Capital in the Examined Enterprises

A. ACTIVE CAPITAL									
Capital Groups		Enterprises Size Groups (Colony)							
		0-100		101-250		251-+		Entr. Avg.	
		TL	%	TL	%	TL	%	TL	%
1. Working (Current) Assets	Financial Asset	1,764.71	16.1	2,500.00	8.86	1,607.27	2.48	1,844.68	3.96
	Receivable Asset	2,970.59	27.2	8,204.55	29.1	18,327.27	28.24	13,180.85	28.3
	Material and Supplies Asset	3,444.85	31.5	9,036.08	32	21,651.09	33.36	15,406.02	33.1
	Main Product Kept in Stock Asset	314.71	2.88	1,240.91	4.4	2,782.73	4.29	1,975.53	4.24
	Byproduct Kept in Stock Asset	0	0	0	0	0	0	0	0
	Cluster to be Sold Asset	2,439.71	22.3	7,222.73	25.6	20,529.09	31.63	14,143.35	30.4
	TOTAL	10,934.56	100	28,204.26	100	64,897.45	100	46,550.44	100
2. Medium-term Assets	Colony Asset (Bee Asset)	10,305.88	90.2	27,476.36	89.1	67,316.36	93.78	47,681.70	93
	Tool-Machinery Asset	1,125.71	9.85	3,362.77	10.9	4,461.53	6.22	3,601.09	7.02
	TOTAL	11,431.59	100	30,839.14	100	71,777.89	100	51,282.79	100
3. Real Fixed Assets	Beehive Asset	26,382.60	95.9	28,527.60	89.5	27,730.80	75.48	27,673.46	81.6
	Shelter Asset	1,125.71	4.09	3,362.77	10.5	6,734.25	18.33	4,930.87	14.5
	Vehicle Asset	0	0	0	0	2,272.73	6.19	1,329.79	3.92
	TOTAL	27,508.31	100	31,890.37	100	36,737.78	100	33,934.12	100
Total Active Capital		49,874.45		90,933.77		173,413.13		131,767.35	
B. PASSIVE CAPITAL									
Capital Groups		Enterprise Groups							
		0-100		101-250		251-+		Entr. Avg.	

1. Debts (Foreign) Capital	Short-term (Current) Debts	0	0	0	0	0	0	0	0
	Medium-term Debts	12,195.29	24.5	18,909.09	20.8	6,023.64	3.47	10,155.53	7.71
	Long-term Debts	2,058.82	4.13	0	0	372.34	5.82	590.2	0.45
	TOTAL	14,254.12	28.6	18,909.09	20.8	6,395.98	9.3	10,745.73	8.16
2. Equity Capital	Equity Capital	35,620.34	71.4	72,024.68	79.2	167,017.15	96.31	121,021.62	91.8
Total Passive Capital		49,874.45	100	90,933.77	100	173,413.13	105.6	131,767.35	100

CONCLUSION

For the beekeeping enterprises within the research's scope, the capital structure of the enterprises should be calculated using the capital distribution depending on the reorganized liquidity, and this should be taken into consideration for the regulations related to the capital structure of beekeeping enterprises. The necessary evaluation should be done for all the beekeepers registered to the beekeeping registration system in order to display the capital status and calculation. In conclusion, from now on the results of the evaluation and examination of the beekeeping enterprises should be determined considering the socio-economic indicators. When evaluating the capital structure of beekeeping enterprises, the capital structure reorganized for beekeeping enterprises should be taken into consideration.

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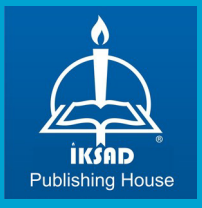

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