Study on Awareness and Knowledge Regarding Eye Diseases among University Students of Bangladesh

A Project Report to be submitted in the Department of Pharmacy for the Partial Fulfillment of the Degree of Bachelor of Pharmacy.

Submitted By

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DECLARATION BY THE RESEARCH CANDIDATE

I, Amit Kumar Biswas, ID: 2012-1-70-021, hereby declare that the dissertation entitled **"Study on Awareness and Knowledge Regarding Eye Diseases among University Students of Bangladesh''** submitted to the Department of Pharmacy, East West University, in the partial fulfillment of the requirement for the degree of Bachelor of Pharmacy (Honors) is a genuine & authentic research work carried out by me. The contents of this dissertation, in full or in parts, have not been submitted to any other institute or University for the award of any degree or Diploma of Fellowship.

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CERTIFICATION BY THE SUPERVISOR

This is to certify that the dissertation, entitled **"Study on Awareness and Knowledge Regarding Eye Diseases among University Students of Bangladesh"** is a bona fide research work done by Amit Kumar Biswas (ID: 2012-1-70-021), in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy under my supervision.

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ENDORSEMENT BY THE CHAIRPERSON

This is to certify that the dissertation, entitled **"Study on Awareness and Knowledge Regarding Eye Diseases among University Students of Bangladesh"** is a bona fide research work done by Amit Kumar Biswas (ID: 2011-1-70-021), under the guidance of **Nishat Nasrin**, Senior Lecturer, in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy.

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DEDICATION

This research paper is dedicated to my beloved parents and my beloved sister **Sushmita Biswas** for their unconditional support.

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List of Abbreviations

CSR	Central Serous Retinopathy
DCCT	Diabetic Control and Complications Center
DHA	Docosahexaenoic Acid
DME	Diabetic Macular Edema
IOL	Intra Ocular Lens
IOP	Intra Ocular Pressure
GP	General Practitioner
NEI	National Eye Institute
OCT	Optical Coherence Tomography
PDR	Proliferative Diabetic Retinopathy
YAG	Yttrium Aluminum Garnet; Nd:Y3Al5O12

Abstract

Eye conditions have emerged as potential threats to the status of sight in many low & middle income and industrialized country populations. The main three eye conditions are Diabetic Retinopathy, Glaucoma and Cataract. The increase of diabetes has caused Diabetic retinopathy to the priority list while glaucoma remains public health agenda due to its treatment difficulties. In Bangladesh Cataract and Night Blindness are two major eye conditions to look at due to lack of proper education and awareness. The aim of the study was to assess the knowledge of common eye conditions namely Cataract, Glaucoma, Diabetic Retinopathy and Night blindness in our country. A total of 572 subjects aged between 19 to 29 years age, who were students of different university participated in the study representing the young generation of the nation. They responded to a structured questionnaires and having heard of the disease in question was defined as 'awareness' and having some understandings of the eye disease was defined as 'knowledge'. The awareness of the Cataract across the entire population was 84%, Night Blindness 94%, Diabetic retinopathy 62%, and Glaucoma 47.5%. The principle source of knowledge was from print and electronic media (average 35%) and friends, family and other relatives (average 28%). The respondents were knowledgeable about Cataract surgery but 52% didn't know about Intraocular Lens Implantation. With Glaucoma and Diabetic Retinopathy most of the students had minimal knowledge about the right treatment. In Diabetic Retinopathy 35% didn't know the frequency of eye check-up and only 10.48% knew about right treatment. From the result it was seen that the knowledge of the eye conditions were was not at satisfactory level among the young generation of the country. Such awareness and knowledge could lead to better understanding and acceptance of the importance of the early detection and treatment of eye diseases.

Keywords- *Eye Disease, Cataract, Glaucoma, Diabetic Retinopathy, Night Blindness, IOL. Epidemiology in Bangladesh.*

Chapter 1

Introduction

1.1 Introduction

The human eye is an organ that reacts to light and has several purposes. As a sense organ, the mammalian eye allows vision. Rod and cone cells in the retina allow conscious light perception and vision including color differentiation and the perception of depth. The human eye can distinguish about 10 million colors.

Similar to the eyes of other mammals, the human eye's non-image-forming photosensitive ganglion cells in the retina receive light signals which affect adjustment of the size of the pupil, regulation and suppression of the hormone patient melatonin and entrainment of the body clock.

1.2 Anatomy of the Eyeball

The eye consists of a retinal-lined fibro vascular sphere which contains the aqueous humor, the lens and the vitreous body as illustrated in Figure 1.1. The retina is the essential component of the eye and serves the primary purpose of photoreception. All other structures of the eye are subsidiary and act to focus images on the retina, to regulate the amount of light entering the eye or to provide nutrition, protection or motion. The retina may be considered as an outlying island of the central nervous system, to which it is connected by a tract of nerve fibers, the optic nerve. As in the case of the brain and the spinal cord, the retina is within two coats of tissue which contribute protection and nourishment. On the outside of the sphere, corresponding to the dura mater, a layer composed of dense fibrous tissue serves as a protective envelope, the fibrous tunic. The posterior part of the fibrous tunic, the sclera, is white and opaque. Although it retains its protective function, the anterior portion, the cornea, is clear and transparent. Immediately internal to the sclera, and between it and the retina, lies the uvea, a vascular tunic analogous to the pia-arachnoid of the central nervous system. Primarily, the uvea provides nutrients to the eye. The posterior portion of the uvea is the choroid, a tissue composed almost entirely of blood vessels. A second portion of the uvea, the ciliary body, lies just anterior to the choroid and posterior to the corneoscleral margin and provides nutrients by forming intraocular fluid, the aqueous humor. In addition, the ciliary body contains muscles which provide a supporting and focusing mechanism for the lens. The most anterior portion of the uveal tract, the iris, is deflected into the interior of the eye. The iris acts as a diaphragm with a central rounded opening, the pupil, which dilates to allow more light to the retina in dim lighting and

constricts in bright lighting. The iris also has some degree of nutritive function, since it acts to help regulate the fluid flow in the eye. The lens, the focusing mechanism of the eye, is located immediately behind the iris and is supported from the ciliary body by a suspensory ligament, the zonule. The space between the iris and the lens is called the posterior chamber. The anterior chamber consists of the space between the iris and the cornea. Behind the lens is the vitreous, a gel-like, transparent body which occupies the space between the lens and the retina (McCaa, 1982).

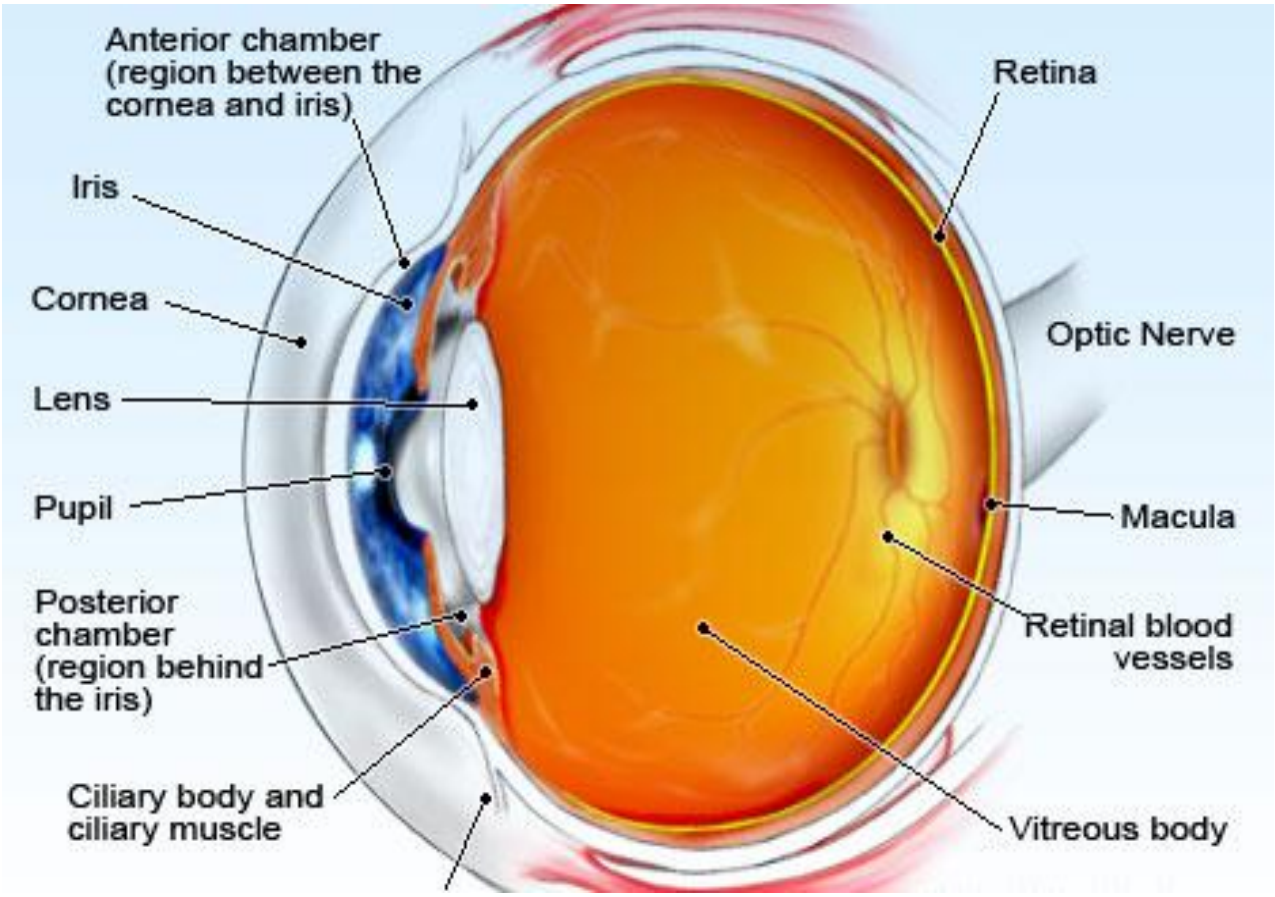

Fig 1.1: Anatomy of the Eyeball (Healthline.com, 2013)

1.2.1 The Cornea

The Cornea, the window of the eye, is unique because of its transparency. Corneal transparency is dependent on a special arrangement of cells and collagenous fibrils in an acid mucopolysaccharide environment, to an absence of blood vessels, and to deturgescence (the state of relative dehydration of corneal tissue).

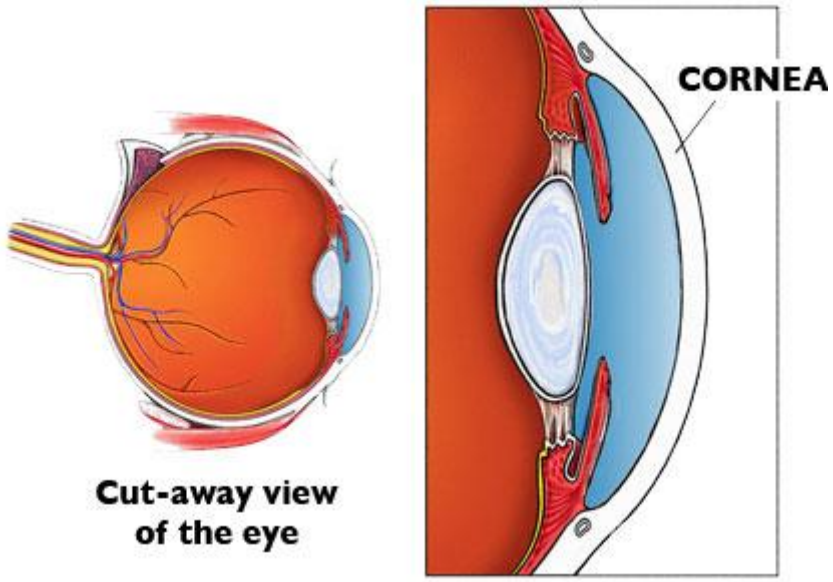

Fig 1.2: Cornea (Jacobsen, 2008)

The cornea is composed of five distinct layers: (1) Epithelium, (2) Bowman's Membrane (3) Stroma (4) Descemet's Membrane and (5) Endothelium. In addition, a tear film always covers the cornea of a healthy eye (McCaa, 1982).

1.2.2 The Tear Film

The tear film is made up of four layers. The portion immediately next to the epithelium is rich in glycoprotein produced by the goblet cells of the conjunctival epithelium; a middle, watery layer is secreted by the lacrimal glands; an outside oily layer is produced by the meibomian glands and the glands of Moll and Zeis of the lid. The tear film is essential for the maintenance of the 2 proper optical qualities of the cornea and its deficiency may result in corneal damage.

1. **Corneal Epithelium**: The corneal epithelium consists of five or six layers of cells which rest on a basement membrane. It is replaced by growth from its basal cells with perhaps greater rapidity than any other stratified epithelium.
2. **Bowman's Membrane**: Bowman's membrane is not a true basement membrane but is a clear acellular layer which is a modified portion of the superficial stroma. It is a homogenous layer without cells and has no capacity to regenerate if injured.
3. **Corneal Stroma**: The stroma makes up approximately 90% of the thickness of the cornea. It consists of alternating lamellae of collagenous tissue parallel to

the surface of the cornea. The corneal cells, or keratocytes, are relatively few and lie within the collagen lamellae.

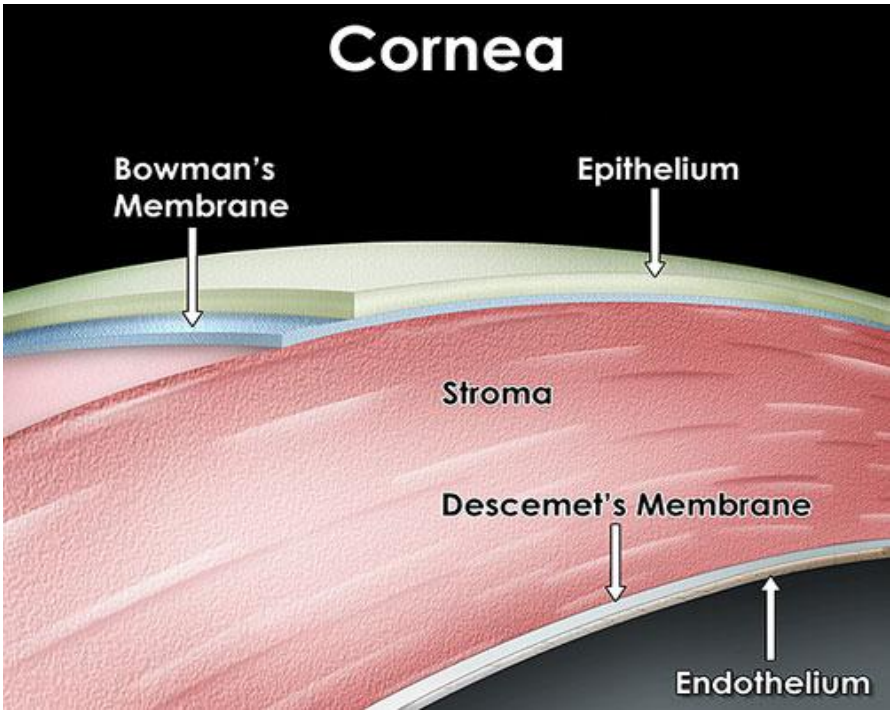

Fig 1.3: Cornea Layers (Batchelor, 1995)

4. **Descemet's Membrane**: Descemet's membrane is a strong, homogeneous true basement membrane. It is produced by the endothelial cells and can be regenerated if injured. Descemet's membrane is elastic and is more resistant than the remainder of the cornea to trauma and disease. Corneal Endothelium. The corneal endothelium consists of a single layer of flattened cuboidal cells. The endothelium does not regenerate and is essential for maintaining dehydration of corneal tissue. Therefore, chemical or physical damage to the endothelium of the cornea is far more serious than epithelial damage. Destruction of the endothelial cells may cause marked swelling of the cornea and result in loss of its transparency (McCaa, 1982).

1.2.3 The Sclera

The sclera is hydrated and has large collagen fibrils arranged haphazardly; therefore, it is opaque and white rather than clear. The sclera has three layers: the episclera, the outer layer; the sclera; and the melanocytic layer, the inner lamina fusca. The episclera, a highly vascular connective tissue, attaches Tenon's capsule to the sclera. The sclera

proper is relatively avascular and contains considerable elastic tissue. The sclera is approximately 1 mm thick posteriorly and gradually thins to about 0.3 mm just posterior to the insertions of the recti muscles. Therefore, these sites posterior to the insertion of the muscles are the areas of the eye which are most liable to rupture with trauma to the globe (Wolff and Last, 1968).

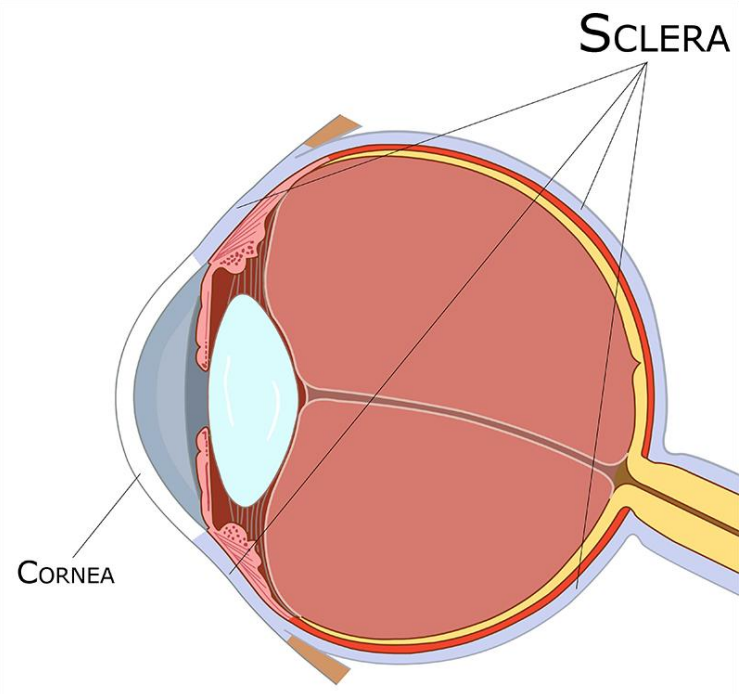

Fig 1.4: The Sclera (Canning, 1999)

1.2.4 The Retina

The sensory retina covers the inner portion of the posterior two-thirds of the wall of the globe. It is a thin structure which in the living state is transparent and of a purplish-red color due to the visual purple of the rods. The retina is a multilayered sheet of neural tissue closely applied to a single layer of pigmented epithelial cells. The sensory retina is attached only at two regions; the anterior extremity is firmly bound to the pigment epithelium at its dentate termination, the ora serrata. Posteriorly, the optic nerve fixes the retina to the wall of the globe. This potential space between the sensory retina and the retinal pigment epithelium may fill with fluid and result in retinal detachment. The fluid usually comes from the vitreous and enters the subretinal space through a tear or hole in the retina (rhegmatogenous or tear-induced retinal detachment). Less commonly, fluid may leak from blood vessels and cause an exudative retinal detachment. The retina is 0.1 mm thick at the ora serrata and 0.23 mm thick at the

posterior pole. It is thinnest at the fovea centralis, the center of the macula. The fovea may suffer irreparable damage in a brief period of separation from its only blood supply, the underlying choriocapillaris, during retinal detachment (Schuman and Meyers, 1968).

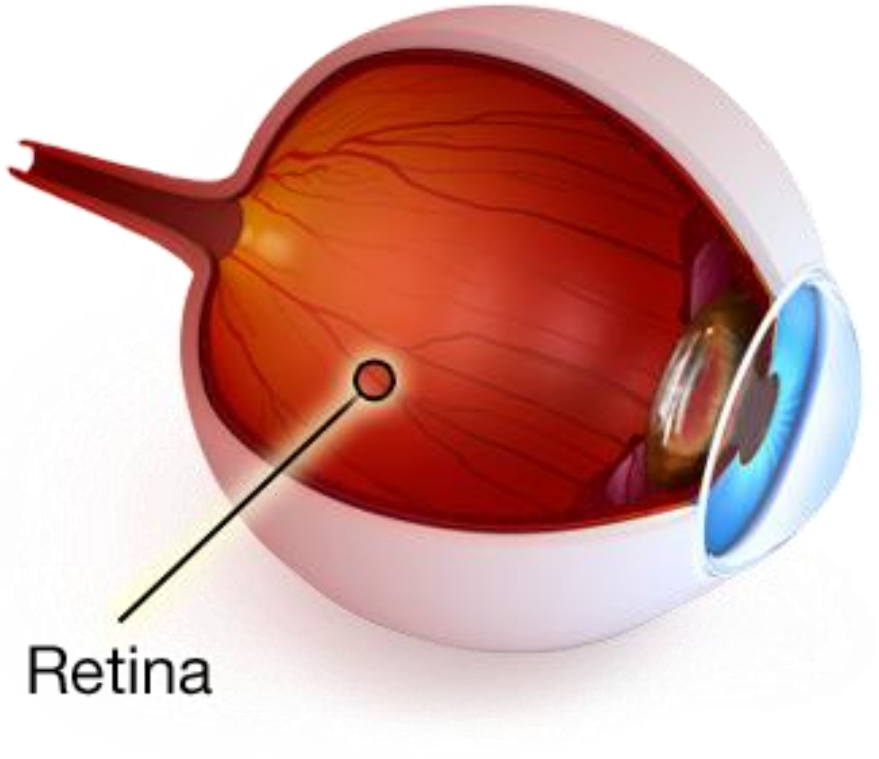

Fig 1.5: Retina of the Eye (Healthline.com, 2013)

1.2.4.1 Composition of the Sensory Retina

The sensory retina is composed of highly organized tissue consisting of nine histologic layers resting on pigment epithelium. From the outside of the eye the layers are in the following order:

(1) The Layer of Rods and Cons;

(2) The External Limiting Membrane;

(3) The Outer Nuclear Layer;

(4) The Outer Plexiform Layer;

(5) The Inner Nuclear Layer;

(6) The Inner Plexiform Layer;

(7) The Ganglion Cell Layer;

(8) The Nerve Fiber Layer;

(9) The Internal Limiting Membrane (Schuman and Meyers, 1968).

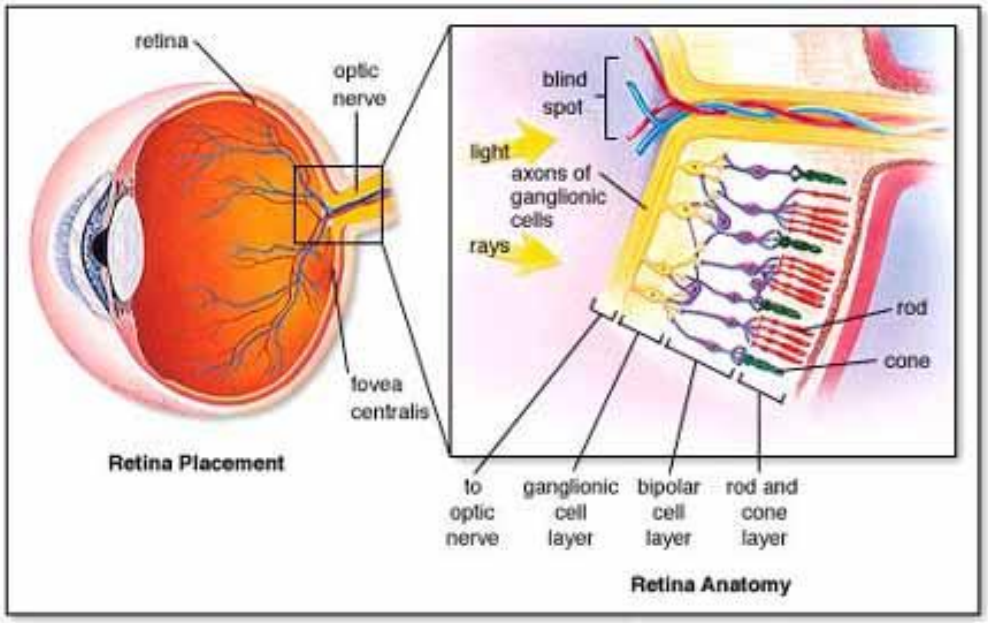

Fig 1.6: Retina Anatomy (Martin, 2015)

1.2.5 Aqueous Humor

Aqueous humor contained in the anterior compartment of the eye, is produced by the ciliary body and drained through outflow channels into the extraocular venous system. The aqueous circulation is a vital element in the maintenance of normal intraocular pressure (IOP) and in the supply of nutrients to avascular transparent ocular media, the lens and the cornea. Circulatory disturbance of the aqueous humor leads to abnormal elevation of the IOP, a condition known as glaucoma, which can ultimately lead to blindness (Wolff and Last, 1968).

1.2.5.1 Aqueous Humor Formation

Formation of aqueous humor is dependent upon the interaction of complex mechanisms within the ciliary body, such as blood flow, transcapillary exchange and transport processes in the ciliary epithelium. Maintenance of the IOP is controlled by a delicate

equilibration of aqueous humor formation and outflow; aqueous formation and ocular blood flow are in turn influenced by the IOP (Wolff and Last, 1968).

1.2.6 The Vitreous

The vitreous is a clear, avascular, gel-like body which comprises two-thirds of the volume and weight of the eye. It fills the space bounded by the lens, retina, and optic disc. Its gelatinous form and consistency is due to a loose syncytium of long-chain collagen molecules capable of binding large quantities of water. The vitreous is about 99% water; collagen and hyaluronic acid make up the remaining 1%. (Gauger and Shon, 2012).

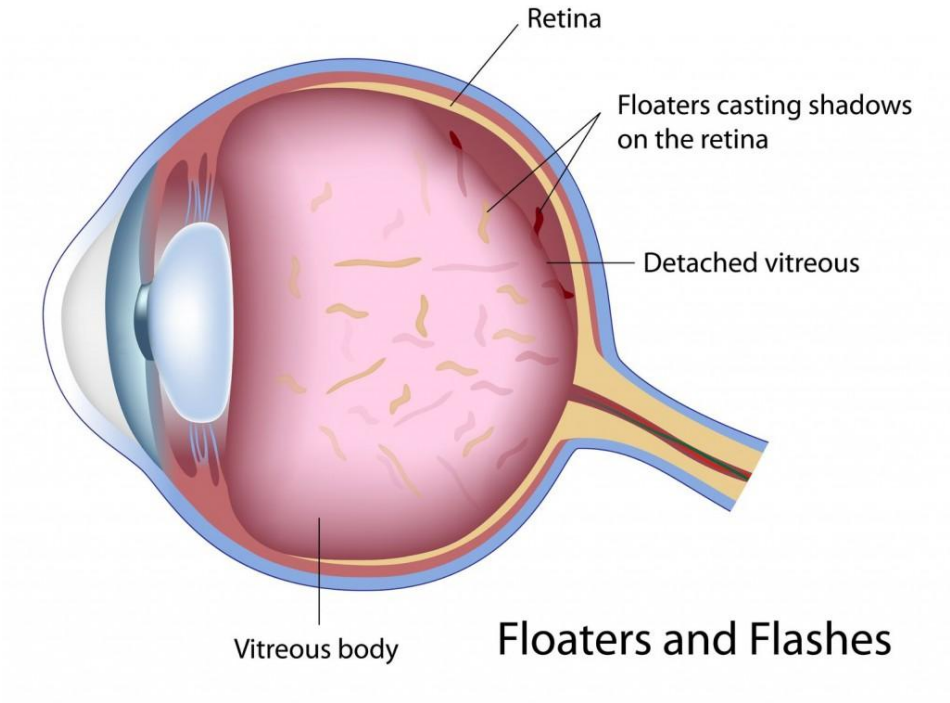

Fig 1.7: The Vitreous (Gauger and Shon, 2012)

1.2.7 The Lens

The lens is a biconvex, transparent, and avascular structure. It is suspended behind the iris by the zonule of Zinn, a suspensory ligament, which connects it with the ciliary body. The lens capsule is a semipermeable membrane which will admit water and electrolytes. A sub-capsular epithelium is present anteriorly. Sub-epithelial lamellar fibers are continuously produced throughout life. The nucleus and cortex of the lens are

made up of long concentric lamellae each of which contains a flattened nucleus in the peripheral portion of the lens near the equator (McCaa, 1982).

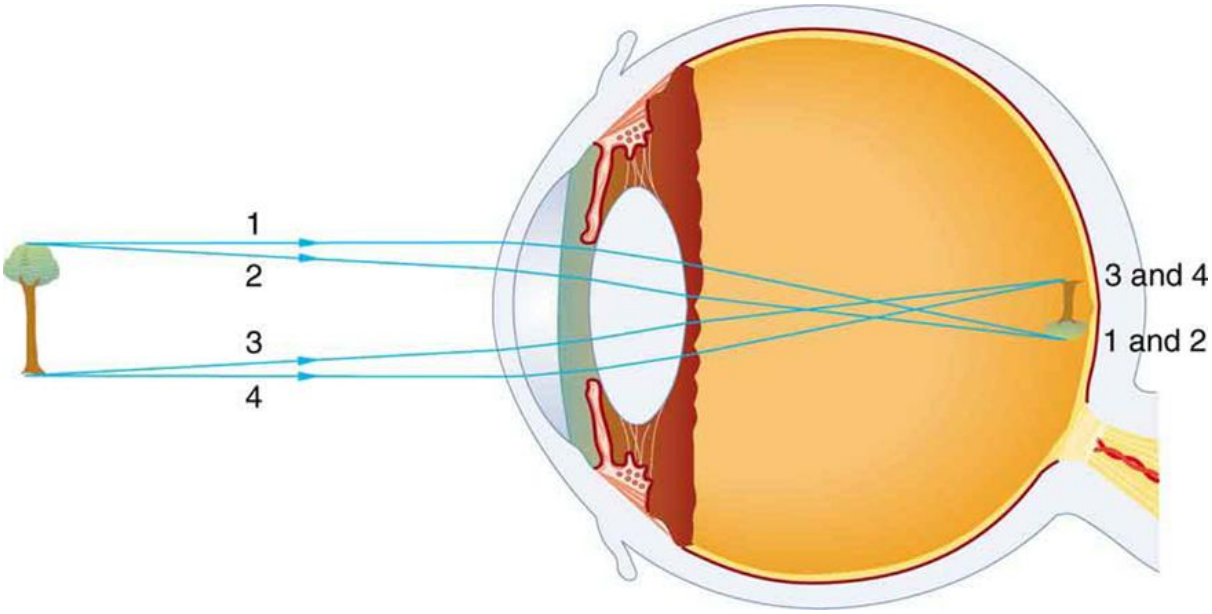

Fig 1.8: The Mechanism of the Lens (Gauger and Shon, 2012)

1.2.7.1 Function of the Lens

The lens acts to focus light rays upon the retina. To focus light from a near object, the ciliary muscle contracts, pulling the choroid forward and releasing the tension on the zonules. The elastic lens capsule then molds the pliable lens into a more spherical shape with greater refractive power. This process is known as accommodation. With age, the lens becomes harder and the ability to accommodate for near objects is decreased (McCaa, 1982).

1.2.7.2 Composition of the Lens

The lens consists of about 65% water and about 35% protein (the highest protein content of any tissue of the body). Potassium is more concentrated in the lens than in most body tissues and ascorbic acid and glutathione are both present in the lens. It contains no nerve fibers or blood vessels; therefore, its nutrition is derived from the surrounding fluids. Mechanical injury to the lens or damage from altered nutrient concentration in the aqueous may result in cataract formation (McCaa, 1982).

1.3 Cataract

A Cataract is a clouding of the lens in the eye that affects vision. Most Cataracts are related to aging. Cataracts are very common in older people. By age 80, more than half of all Americans either have a Cataract or have had Cataract surgery. A Cataract can occur in either or both eyes. It cannot spread from patient eye to the other (Jacobsen, 2008).

Fig 1.9: Vision in Cataract (Marazzi, 2016)

1.3.1 Types of Cataract

Although most Cataracts are related to aging, there are other types of Cataract:

1. **Secondary Cataract:** Cataracts can form after surgery for other eye problems, such as glaucoma. Cataracts also can develop in people who have other health problems, such as diabetes. Cataracts are sometimes linked to steroid use.
2. **Traumatic Cataract:** Cataracts can develop after an eye injury, sometimes years later.
3. **Congenital Cataract:** Some babies are born with Cataracts or develop them in childhood, often in both eyes. These Cataracts may be so small that they do not affect vision. If they do, the lenses may need to be removed.
4. **Radiation Cataract:** Cataracts can develop after exposure to some types of radiation (Jacobsen, 2008).

1.3.2 Cause of Cataract

The lens lies behind the iris and the pupil. It works much like a camera lens. It focuses light onto the retina at the back of the eye, where an image is recorded. The lens also adjusts the eye's focus, letting us see things clearly both up close and far away. The lens is made of mostly water and protein. The protein is arranged in a precise way that keeps the lens clear and let light pass through it.

But as we age, some of the protein may clump together and start to cloud a small area of the lens. This is a Cataract. Over time, the Cataract may grow larger and cloud more of the lens, making it harder to see.

Researchers suspect that there are several causes of Cataract, such as smoking and diabetes. Or, it may be that the protein in the lens just changes from the wear and tear it takes over the years (National Eye Institute, 2009).

1.3.3 How Cataracts Affect the Vision

Age-related Cataracts can affect Patient's vision in two ways:

1. Clumps of protein reduce the sharpness of the image reaching the retina. The lens consists mostly of water and protein. When the protein clumps up, it clouds the lens and reduces the light that reaches the retina. The clouding may become severe enough to cause blurred vision. Most age-related Cataracts develop from protein clumping.

   When a Cataract is small, the cloudiness affects only a small part of the lens. Patient may not notice any changes in patient's vision. Cataracts tend to "grow" slowly, so vision gets worse gradually. Over time, the cloudy area in the lens may get larger, and the Cataract may increase in size. Seeing may become more difficult. Patient's vision may get duller or blurrier.

2. The clear lens slowly changes to a yellowish/brownish color, adding a brownish tint to vision. As the clear lens slowly colors with age, Patient's vision gradually may acquire a brownish shade. At first, the amount of tinting may be small and may not cause a vision problem. Over time, increased tinting may make it more difficult to read and perform other routine activities. This gradual change in the

amount of tinting does not affect the sharpness of the image transmitted to the retina.

If patient has advanced lens discoloration, patient may not be able to identify blues and purples. Patient may be wearing what patient believe to be a pair of black socks, only to find out from friends that patient are wearing purple socks (American Association for Pediatric Ophthalmology and Strabismus, 2014).

Fig 1.10: Cataract affected Eye (Marazzi, 2016)

1.3.4 Risk factors

The risk of Cataract increases as patient gets older. Other risk factors for Cataract include:

1. Certain diseases such as diabetes.
2. Personal behavior such as smoking and alcohol use.
3. The environment such as prolonged exposure to sunlight (National Eye Institute, 2009).

1.3.5 Symptoms of Cataract

The most common symptoms of a Cataract are:

- Cloudy or blurry vision.
- Colors seem faded.

- Glare. Headlights, lamps, or sunlight may appear too bright. A halo may appear around lights.
- Poor night vision.
- Double vision or multiple images in patient eye. (This symptom may clear as the Cataract gets larger.)
- Frequent prescription changes in Patient's eyeglasses or contact lenses.
- These symptoms also can be a sign of other eye problems. If patient have any of these symptoms, check with Patient's eye care professional (National Eye Institute, 2009).

1.3.6 Cataract Detection

Cataract is detected through a comprehensive eye exam that includes:

1. **Visual Acuity Test:** This eye chart test measures how well patient see at various distances.
2. **Dilated Eye Exam:** Drops are placed in Patient's eyes to widen, or dilate, the pupils. Patient's eye care professional uses a special magnifying lens to examine Patient's retina and optic nerve for signs of damage and other eye problems. After the exam, Patient's close-up vision may remain blurred for several hours.
3. **Tonometry:** An instrument measures the pressure inside the eye. Numbing drops may be applied to Patient's eye for this test. Eye care professional also may do other tests to learn more about the structure and health of patient's eye (American Association for Pediatric Ophthalmology and Strabismus, 2014).

1.3.7 Treatment

The symptoms of early Cataract may be improved with new eyeglasses, brighter lighting, anti-glare sunglasses, or magnifying lenses. If these measures do not help, surgery is the only effective treatment. Surgery involves removing the cloudy lens and replacing it with an artificial lens.

A Cataract needs to be removed only when vision loss interferes with Patient's everyday activities, such as driving, reading, or watching TV. Patient and Patient's eye care professional can make this decision together. Once patient understand the benefits and risks of surgery, patient can make an informed decision about whether Cataract

surgery is right for patient. In most cases, delaying Cataract surgery will not cause long-term damage to Patient's eye or make the surgery more difficult. Patient does not have to rush into surgery.

Sometimes a Cataract should be removed even if it does not cause problems with Patient's vision. For example, a Cataract should be removed if it prevents examination or treatment of another eye problem, such as age-related macular degeneration or diabetic retinopathy. If Patient's eye care professional finds a Cataract, patient may not need Cataract surgery for several years. In fact, patient might never need Cataract surgery. By having Patient's vision tested regularly, patient and Patient's eye care professional can discuss if and when patient might need treatment.

If patient chooses surgery, Patient's eye care professional may refer patient to a specialist to remove the Cataract. If patient have Cataracts in both eyes that require surgery, the surgery will be performed on each eye at separate times, usually four to eight weeks apart.

Many people who need Cataract surgery also have other eye conditions, such as age-related macular degeneration or glaucoma. If patient has other eye conditions in addition to Cataract, talk with Patient's doctor. Learn about the risks, benefits, alternatives, and expected results of Cataract surgery (National Eye Institute, 2009).

1.3.7.1 Types of Cataract surgery

There are two types of Cataract surgery. Patient's doctor can explain the differences and help determine which is better for patient:

1. **Phacoemulsification** or **phaco**. A small incision is made on the side of the cornea, the clear, dome-shaped surface that covers the front of the eye. Patient's doctor inserts a tiny probe into the eye. This device emits ultrasound waves that soften and break up the lens so that it can be removed by suction. Most Cataract surgery today is done patient by phacoemulsification, also called "small incision Cataract surgery."
2. **Extra capsular surgery**. Patient's doctor makes a longer incision on the side of the cornea and removes the cloudy core of the lens in patient piece. The rest of the lens is removed by suction.

After the natural lens has been removed, it often is replaced by an artificial lens, called an intraocular lens (IOL). An IOL is a clear, plastic lens that requires no care and becomes a permanent part of patient's eye. Light is focused clearly by the IOL onto the retina, improving Patient's vision. Patient will not feel or see the new lens.

Some people cannot have an IOL. They may have another eye disease or have problems during surgery. For these Patient's, a soft contact lens, or glasses that provide high magnification, may be suggested (American Association for Pediatric Ophthalmology and Strabismus, 2014).

1.3.8 Intraocular Lens Implantation (IOL)

An intraocular lens implant is a synthetic, artificial lens placed inside the eye that replaces the focusing power of a natural lens that is surgically removed, usually as part of cataract surgery.

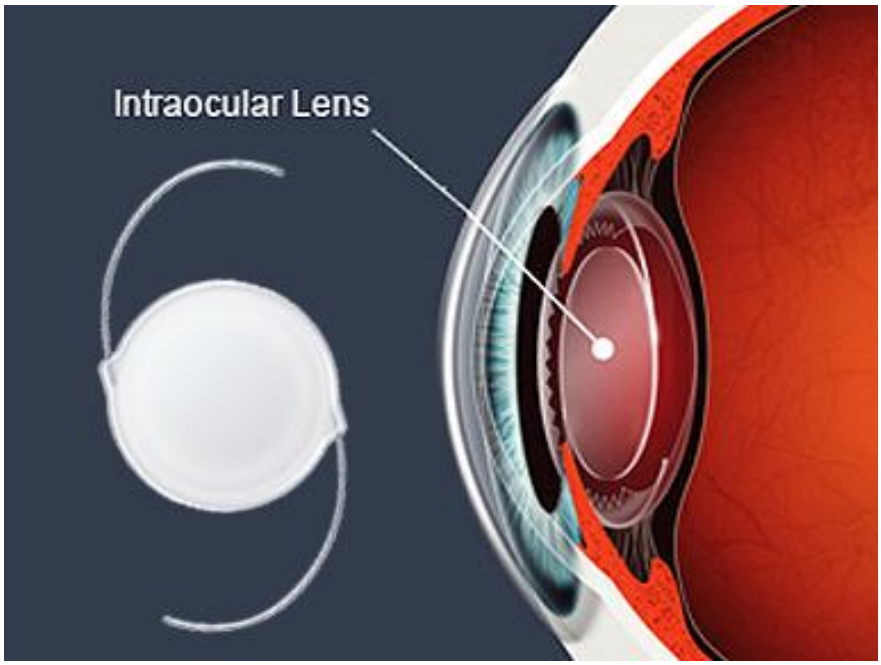

Fig 1.11: Intraocular Lens Implant (Boyd, 2015)

1.3.8.1 Why Intraocular Lens Implant is Used

When the natural lens is removed, much of the eye's focusing ability is lost. To restore vision, lost focusing power is usually replaced by patient of three methods. The first method is the use of glasses (spectacles). The required lens power is high and the corrective lens quite thick. This option is less desirable for cataract surgery on patient

eye since the magnification caused by the patient thick lens may hinder binocularity. The second option is to wear a contact lens. This option can be utilized for cataract surgery on patient or both eyes. However, handling and/or tolerating a contact lens can be difficult for some children. The third option is to place a permanent IOL inside the eye, making compliance less of an issue (National Eye Institute, 2009).

1.3.8.2 Considerations of Cataract Surgery for a Child

In addition to the infrequent risks of any intraocular surgery, (infection, bleeding, inflammation, retinal detachment, etc.) there are special considerations for a child. Children's eyes can develop inflammation after cataract surgery, especially when an IOL is placed. Inflammation sometimes makes further surgery necessary. Glaucoma also occurs more frequently after cataract surgery in children. Lastly, cataract surgery for a child usually requires general anesthesia (National Eye Institute, 2009).

1.3.8.3 IOL Age Limitations

An IOL is frequently utilized when cataract surgery is performed after the first birthday. The use of an IOL in the first year of life, especially in the first few months of life, is investigational. A national study was recently conducted under the auspices of the FDA and the National Institutes of Health to determine if an IOL is a viable option for infants. This study demonstrated that visual outcomes were similar in infants treated with an IOL compared to those treated with a contact lens. However, there was an increased risk of complications and need for additional surgeries in the IOL group. If a contact lens or glasses are used initially, secondary IOL insertion can be considered when the child is older and eye growth more complete. Use of an intraocular lens is an individualized decision for each child made after discussion with the ophthalmologist (Boyd, 2015).

1.3.9 Risks of Cataract Surgery

As with any surgery, Cataract surgery poses risks, such as infection and bleeding. Before Cataract surgery, Patient's doctor may ask patient to temporarily stop taking certain medications that increase the risk of bleeding during surgery. After surgery, patient must keep Patient's eye clean, wash Patient's hands before touching Patient's eye, and use the prescribed medications to help minimize the risk of infection. Serious

infection can result in loss of vision (American Association for Pediatric Ophthalmology and Strabismus, 2014).

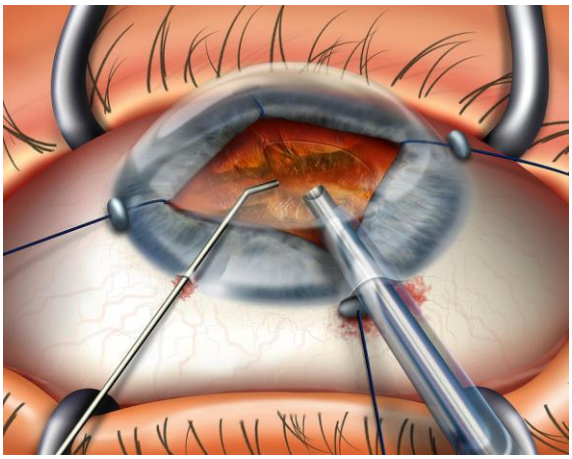

Fig 1.12: Cataract Surgery (Boyd, 2015)

Cataract surgery slightly increases Patient's risk of retinal detachment. Other eye disorders, such as high myopia (nearsightedness), can further increase Patient's risk of retinal detachment after Cataract surgery. Patient sign of a retinal detachment is a sudden increase in flashes or floaters. Floaters are little "cobwebs" or specks that seem to float about in Patient's field of vision. If patient notice a sudden increase in floaters or flashes, see an eye care professional immediately. A retinal detachment is a medical emergency. If necessary, go to an emergency service or hospital. Patient's eye must be examined by an eye surgeon as soon as possible. A retinal detachment causes no pain. Early treatment for retinal detachment often can prevent permanent loss of vision. The sooner patient get treatment, the more likely patient will regain good vision. Even if patient is treated promptly, some vision may be lost. Talk to eye care professional about these risks. Make sure Cataract surgery is right for patient (American Association for Pediatric Ophthalmology and Strabismus, 2014).

1.3.10 Effectiveness of Cataract Surgery

Cataract removal is patient of the most common operations performed in the eye hospitals. It also is patient of the safest and most effective types of surgery. In about 90 percent of cases, people who have Cataract surgery have better vision afterward (Congdon, 2001).

1.3.10.1 During Surgery

At the hospital or eye clinic, drops will be put into Patient's eye to dilate the pupil. The area around Patient's eye will be washed and cleansed.

The operation usually lasts less than patient hour and is almost painless. Many people choose to stay awake during surgery. Others may need to be put to sleep for a short time.

If patient is awake, patient will have an anesthetic to numb the nerves in and around Patient's eye.

After the operation, a patch may be placed over Patient's eye. Patient will rest for a while. Patient's medical team will watch for any problems, such as bleeding. Most people who have Cataract surgery can go home the same day. Patient will need someone to drive patient home (Congdon, 2001).

1.3.10.2 After Surgery

Itching and mild discomfort are normal after Cataract surgery. Some fluid discharge is also common. Patient's eye may be sensitive to light and touch. If patient has discomfort, Patient's doctor can suggest treatment. After patient or two days, moderate discomfort should disappear.

For a few days after surgery, Patient's doctor may ask patient to use eye drops to help healing and decrease the risk of infection. Ask Patient's doctor about how to use Patient's eye drops, how often to use them, and what effects they can have. Patient will need to wear an eye shield or eyeglasses to help protect Patient's eye. Avoid rubbing or pressing on Patient's eye.

When patient are home, try not to bend from the waist to pick up objects on the floor. Do not lift any heavy objects. Patient can walk, climb stairs, and do light household chores.

In most cases, healing will be complete within eight weeks. Patient's doctor will schedule exams to check on Patient's progress (Congdon, 2001).

1.3.10.3 Problems after Surgery

Problems after surgery are rare, but they can occur. These problems can include infection, bleeding, inflammation (Pain, Redness, and Swelling), Loss of vision,

Double vision, and High or Low eye pressure. With prompt medical attention, these problems can usually be treated successfully.

Sometimes the eye tissue that encloses the IOL becomes cloudy and may blur Patient's vision. This condition is called an after-Cataract. An after-Cataract can develop months or years after Cataract surgery.

An after-Cataract is treated with a laser. Patient's doctor uses a laser to make a tiny hole in the eye tissue behind the lens to let light pass through. This outpatient procedure is called a YAG laser capsulotomy. It is painless and rarely results in increased eye pressure or other eye problems. As a precaution, Patient's doctor may give patient eye drops to lower Patient's eye pressure before or after the procedure (Congdon, 2001).

1.4 Diabetic Retinopathy

Diabetic Retinopathy is a condition occurring in persons with diabetes, which causes progressive damage to the retina, the light sensitive lining at the back of the eye. It is a serious sight-threatening complication of diabetes. Diabetes is a disease that interferes with the body's ability to use and store sugar, which can cause many health problems. Too much sugar in the blood can cause damage throughout the body, including the eyes. Over time, diabetes affects the circulatory system of the retina.

Diabetic Retinopathy is the result of damage to the tiny blood vessels that nourish the retina. They leak blood and other fluids that cause swelling of retinal tissue and clouding of vision. The condition usually affects both eyes. The longer a person has diabetes, the more likely they will develop Diabetic Retinopathy. If left untreated, Diabetic Retinopathy can cause blindness (National Eye Institute, 2015)

1.4.1 Causes of Diabetic Retinopathy

Chronically high blood sugar from diabetes is associated with damage to the tiny blood vessels in the retina, leading to Diabetic Retinopathy. The retina detects light and converts it to signals sent through the optic nerve to the brain. Diabetic Retinopathy can cause blood vessels in the retina to leak fluid or hemorrhage (bleed), distorting vision. In its most advanced stage, new abnormal blood vessels proliferate (increase in number) on the surface of the retina, which can lead to scarring and cell loss in the retina.

Diabetic Retinopathy may progress through four stages:

1. **Mild Nonproliferative Retinopathy:** Small areas of balloon-like swelling in the retina's tiny blood vessels, called microaneurysms, occur at this earliest stage of the disease. These microaneurysms may leak fluid into the retina.
2. **Moderate Nonproliferative Retinopathy:** As the disease progresses, blood vessels that nourish the retina may swell and distort. They may also lose their ability to transport blood. Both conditions cause characteristic changes to the appearance of the retina and may contribute to DME.
3. **Severe Nonproliferative Retinopathy:** Many more blood vessels are blocked, depriving blood supply to areas of the retina. These areas secrete growth factors that signal the retina to grow new blood vessels.
4. **Proliferative Diabetic Retinopathy (PDR):** At this advanced stage, growth factors secreted by the retina trigger the proliferation of new blood vessels, which grow along the inside surface of the retina and into the vitreous gel, the fluid that fills the eye. The new blood vessels are fragile, which makes them more likely to leak and bleed. Accompanying scar tissue can contract and cause retinal detachment—the pulling away of the retina from underlying tissue, like wallpaper peeling away from a wall. Retinal detachment can lead to permanent vision loss (American Optometric Association, 2016).

1.4.2 People at Risk for Diabetic Retinopathy

People with all types of diabetes (type 1, type 2, and gestational) are at risk for Diabetic Retinopathy. Risk increases the longer a person has diabetes. Between 40 and 45 percent of Americans diagnosed with diabetes have some stage of Diabetic Retinopathy, although only about half are aware of it. Women who develop or have diabetes during pregnancy may have rapid onset or worsening of Diabetic Retinopathy (American Optometric Association, 2016).

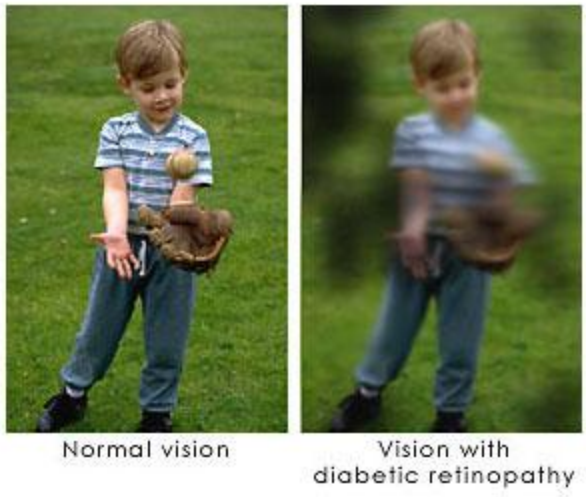

Fig 1.13: Vision with Diabetic Retinopathy (National Eye Institute, 2015)

1.4.3 Risk factors

Risk factors for Diabetic Retinopathy include:

- **Diabetes**—people with Type 1 or Type 2 diabetes are at risk for the development of Diabetic Retinopathy. The longer a person has diabetes, the more likely they are to develop Diabetic Retinopathy, particularly if the diabetes is poorly controlled.
- **Race**—Hispanic and African Americans are at greater risk for developing Diabetic Retinopathy.
- **Medical conditions**—persons with other medical conditions such as high blood pressure and high cholesterol are at greater risk.
    - **Pregnancy**—pregnant women face a higher risk for developing diabetes and Diabetic Retinopathy. If gestational diabetes develops, the patient is at much higher risk of developing diabetes as they age (National Eye Institute, 2015).

1.4.4 Symptoms

Patient won't usually notice Diabetic Retinopathy in the early stages, as it doesn't tend to have any obvious symptoms until it's more advanced.

However, early signs of the condition can be picked up by taking photographs of the eyes during Diabetic eye screening.

Contact patients GP or diabetes care team immediately if patient experience:

- Gradually worsening vision
- Sudden vision loss
- Shapes floating in patients field of vision (floaters)
- Blurred or patchy vision
- Eye pain or redness

These symptoms don't necessarily mean patient have Diabetic Retinopathy, but it's important to get them checked out. Don't wait until patient's next screening appointment (American Optometric Association, 2016).

1.4.5 Detection

Diabetic Retinopathy and DME are detected during a comprehensive dilated eye exam that includes:

1. **Visual acuity testing:** This eye chart test measures a person's ability to see at various distances.
2. **Tonometry:** This test measures pressure inside the eye.
3. **Pupil dilation:** Drops placed on the eye's surface dilate (widen) the pupil, allowing a physician to examine the retina and optic nerve.
4. **Optical coherence tomography (OCT):** This technique is similar to ultrasound but uses light waves instead of sound waves to capture images of tissues inside the body. OCT provides detailed images of tissues that can be penetrated by light, such as the eye.

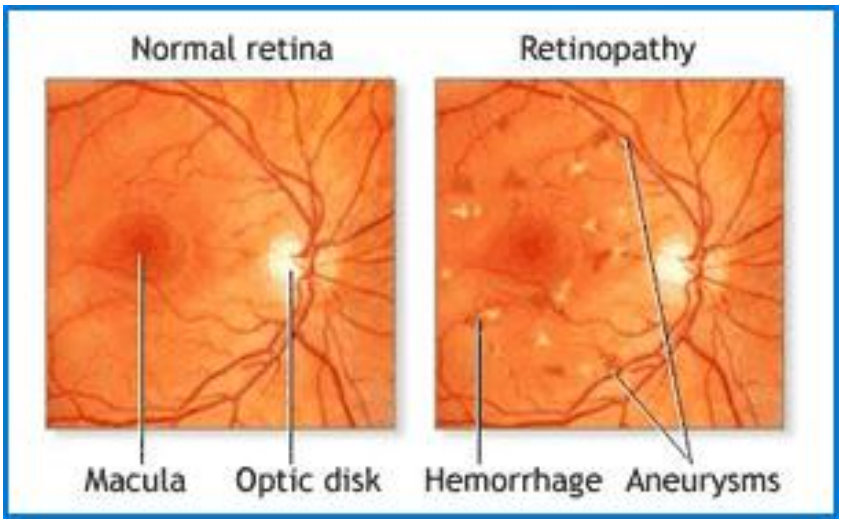

Fig 1.14: Diabetic Retinopathy State (American Optometric Association, 2016)

A comprehensive dilated eye exam allows the doctor to check the retina for:

1. Changes to blood vessels
2. Leaking blood vessels or warning signs of leaky blood vessels, such as fatty deposits
3. Swelling of the macula (DME)
4. Changes in the lens
5. Damage to nerve tissue

If Diabetic Retinopathy is suspected, a fluorescein angiogram may be used to look for damaged or leaky blood vessels. In this test, a fluorescent dye is injected into the bloodstream, often into an arm vein. Pictures of the retinal blood vessels are taken as the dye reaches the eye (National Health Services, 2016).

1.4.6 Treatment

Laser treatment (photocoagulation) is used to stop the leakage of blood and fluid into the retina. A laser beam of light can be used to create small burns in areas of the retina with abnormal blood vessels to try to seal the leaks.

Treatment for Diabetic Retinopathy depends on the stage of the disease and is directed at trying to slow or stop the progression of the disease. In the early stages of Non-proliferative Diabetic Retinopathy, treatment other than regular monitoring may not be required. Following patient's doctor's advice for diet and exercise and keeping blood sugar levels well-controlled can help control the progression of the disease.

If the disease advances, leakage of fluid from blood vessels can lead to macular edema. Laser treatment (photocoagulation) is used to stop the leakage of blood and fluid into the retina. A laser beam of light can be used to create small burns in areas of the retina with abnormal blood vessels to try to seal the leaks. When blood vessel growth is more widespread throughout the retina, as in proliferative Diabetic Retinopathy, a pattern of scattered laser burns is created across the retina. This causes abnormal blood vessels to shrink and disappear. With this procedure, some side vision may be lost in order to safeguard central vision. Some bleeding into the vitreous gel may clear up on its own. However, if significant amounts of blood leak into the vitreous fluid in the eye, it will cloud vision and can prevent laser photocoagulation from being used. A surgical

procedure called a vitrectomy may be used to remove the blood-filled vitreous and replace it with a clear fluid to maintain the normal shape and health of the eye.

Persons with Diabetic Retinopathy can suffer significant vision loss. Special low vision devices such as Telescopic and Microscopic lenses, Hand and stand magnifiers, and Video magnification systems can be prescribed to make the most of remaining vision (National Eye Institute, 2015).

1.4.6.1 Vitrectomy

A vitrectomy is the surgical removal of the vitreous gel in the center of the eye. The procedure is used to treat severe bleeding into the vitreous, and is performed under local or general anesthesia. Ports (temporary water-tight openings) are placed in the eye to allow the surgeon to insert and remove instruments, such as a tiny light or a small vacuum called a vitrector. A clear salt solution is gently pumped into the eye through patient of the ports to maintain eye pressure during surgery and to replace the removed vitreous. The same instruments used during vitrectomy also may be used to remove scar tissue or to repair a detached retina (National Health Services, 2016).

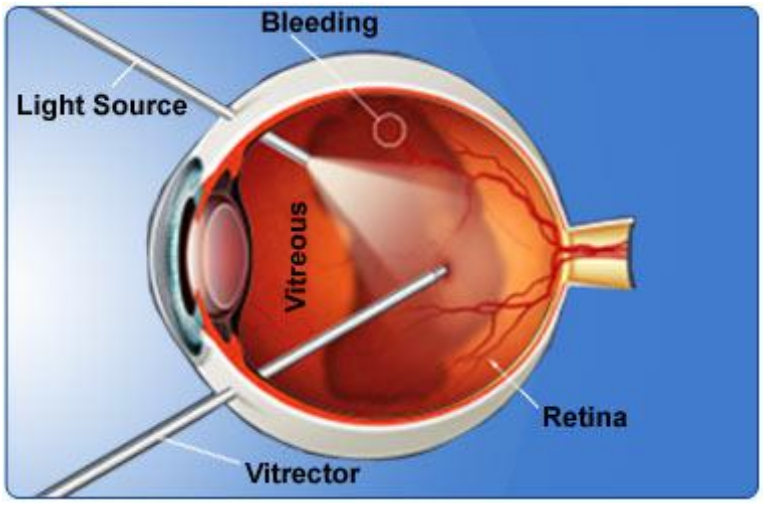

Fig 1.15: Vitrectomy (Wikipedia, 2016)

Vitrectomy may be performed as an outpatient procedure or as an inpatient procedure, usually requiring a single overnight stay in the hospital. After treatment, the eye may be covered with a patch for days to weeks and may be red and sore. Drops may be applied to the eye to reduce inflammation and the risk of infection. If both eyes require vitrectomy, the second eye usually will be treated after the first eye has recovered (National Health Services, 2016).

1.4.7 Prevention and Protection

Vision lost to Diabetic Retinopathy is sometimes irreversible. However, early detection and treatment can reduce the risk of blindness by 95 percent. Because Diabetic Retinopathy often lacks early symptoms, people with diabetes should get a comprehensive dilated eye exam at least once a year. People with Diabetic Retinopathy may need eye exams more frequently. Women with diabetes who become pregnant should have a comprehensive dilated eye exam as soon as possible. Additional exams during pregnancy may be needed.

Studies such as the Diabetes Control and Complications Trial (DCCT) have shown that controlling diabetes slows the onset and worsening of Diabetic Retinopathy. DCCT study participants who kept their blood glucose level as close to normal as possible were significantly less likely than those without optimal glucose control to develop Diabetic Retinopathy, as well as kidney and nerve diseases. Other trials have shown that controlling elevated blood pressure and cholesterol can reduce the risk of vision loss among people with diabetes.

Treatment for Diabetic Retinopathy is often delayed until it starts to progress to PDR, or when DME (Diabetic Macular Edema) occurs. Comprehensive dilated eye exams are needed more frequently as Diabetic Retinopathy becomes more severe. People with severe non-proliferative Diabetic Retinopathy have a high risk of developing PDR and may need a comprehensive dilated eye exam as often as every 2 to 4 months (National Health Services, 2016).

1.5 Glaucoma

Glaucoma is a group of diseases that damage the eye’s optic nerve and can result in vision loss and blindness. However, with early detection and treatment, patient can often protect patient`s eyes against serious vision loss. There is no cure for Glaucoma. Vision lost from the disease cannot be restored (Boyd, 2015).

Fig 1.16: Glaucoma Patient Eye (Boyd, 2015)

1.5.1 People at risk for Open-Angle Glaucoma

Anyone can develop Glaucoma. Some people, listed below, are at higher risk than others:

- African Americans over age 40
- Everyone over age 60, especially Mexican Americans
- People with a family history of Glaucoma

A comprehensive dilated eye exam can reveal more risk factors, such as high eye pressure, thinness of the cornea, and abnormal optic nerve anatomy. In some people with certain combinations of these high-risk factors, medicines in the form of eye-drops reduce the risk of developing Glaucoma by about half (Boyd, 2015).

1.5.2 Glaucoma Risk Factors

Because chronic forms of glaucoma can destroy vision before any signs or symptoms are apparent, be aware of these risk factors:

- Having high internal eye pressure (intraocular pressure)
- Being over age 60
- Being black or Hispanic
- Having a family history of the condition

- Having certain medical conditions, such as diabetes, heart disease, high blood pressure and sickle cell anemia
- Having certain eye conditions, such as nearsightedness
- Having had an eye injury or certain types of eye surgery
- Early estrogen deficiency, such as can occur after removal of both ovaries (bilateral oophorectomy) before age 43
    - Taking corticosteroid medications, especially eye drops, for a long time (Maclain and Bonny, 2006).

1.5.3 Symptoms

At first, open-angle Glaucoma has no symptoms. It causes no pain. Vision stays normal. Glaucoma can develop in patient or both eyes.

Without treatment, people with Glaucoma will slowly lose their peripheral (side) vision. As Glaucoma remains untreated, people may miss objects to the side and out of the corner of their eye. They seem to be looking through a tunnel. Over time, straight-ahead (central) vision may decrease until no vision remains (National Eye Institute, 2016).

1.5.4 How the Optic Nerve Gets Damaged by Open-Angle Glaucoma

Several large studies have shown that eye pressure is a major risk factor for optic nerve damage. In the front of the eye is a space called the anterior chamber. A clear fluid flows continuously in and out of the chamber and nourishes nearby tissues. The fluid leaves the chamber at the open angle where the cornea and iris meet. (See diagram below.) When the fluid reaches the angle, it flows through a spongy meshwork, like a drain, and leaves the eye.

In open-angle Glaucoma, even though the drainage angle is “open”, the fluid passes too slowly through the meshwork drain. Since the fluid builds up, the pressure inside the eye rises to a level that may damage the optic nerve. When the optic nerve is damaged from increased pressure, open-angle Glaucoma-and vision loss—may result. That’s why controlling pressure inside the eye is important.

Another risk factor for optic nerve damage relates to blood pressure. Thus, it is important to also make sure that patient`s blood pressure is at a proper level for patient`s body by working with patient`s medical doctor (National Eye Institute, 2016).

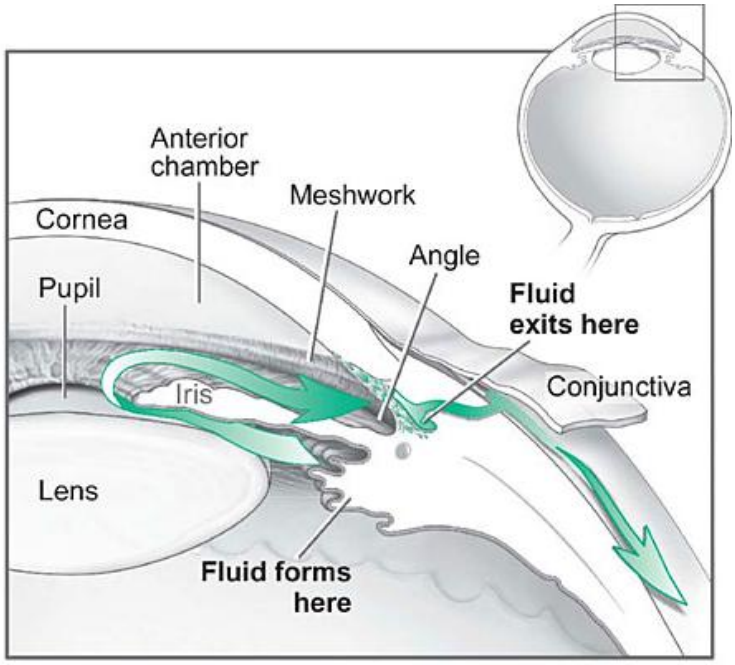

Fig 1.17: Fluid Pathway in Optic Nerve Damage (National Eye Institute, 2016)

1.5.5 Detection of Glaucoma

Glaucoma is detected through a comprehensive dilated eye exam that includes the following:

1. **Visual Acuity Test**: This eye chart test measures how well patient see at various distances.

2. **Visual Field Test**: This test measures patient`s peripheral (side vision). It helps patient`s eye care professional tell if patient have lost peripheral vision, a sign of Glaucoma.

3. **Dilated Eye Exam**: In this exam, drops are placed in patient`s eyes to widen, or dilate, the pupils. Patient`s eye care professional uses a special magnifying lens to examine patient`s retina and optic nerve for signs of damage and other eye

problems. After the exam, patient`s close-up vision may remain blurred for several hours.

4. **Tonometry:** It is the measurement of pressure inside the eye by using an instrument called a tonometer. Numbing drops may be applied to patient`s eye for this test. A tonometer measures pressure inside the eye to detect Glaucoma.

5. **Pachymetry:** It is the measurement of the thickness of patient`s cornea. Patient`s eye care professional applies a numbing drop to patient`s eye and uses an ultrasonic wave instrument to measure the thickness of patient`s cornea (Maclain and Bonny, 2006).

1.5.6 Glaucoma Treatments

Immediate treatment for early-stage, open-angle Glaucoma can delay progression of the disease. That's why early diagnosis is very important.

Glaucoma treatments include Medicines, Laser Trabeculoplasty, Conventional Surgery, or a combination of any of these. While these treatments may save remaining vision, they do not improve sight already lost from Glaucoma.

1. **Medicines**: Medicines, in the form of eye drops or pills, are the most common early treatment for Glaucoma. Taken regularly, these eye drops lower eye pressure. Some medicines cause the eye to make less fluid. Others lower pressure by helping fluid drain from the eye.

Before patient begin Glaucoma treatment, tell patient`s eye care professional about other medicines and supplements that patient are taking. Sometimes the drops can interfere with the way other medicines work.

Glaucoma medicines need to be taken regularly as directed by patient`s eye care professional. Most people have no problems. However, some medicines can cause headaches or other side effects. For example, drops may cause stinging, burning, and redness in the eyes.

Many medicines are available to treat Glaucoma. If patient have problems with patient medicine, tell patient`s eye care professional. Treatment with a different dose or a new medicine may be possible.

Because Glaucoma often has no symptoms, people may be tempted to stop taking, or may forget to take, their medicine. Patient need to use the drops or pills as long as they help control patient`s eye pressure. Regular use is very important.

Make sure patient`s eye care professional shows patient how to put the drops into patient`s eye. For tips on using patient`s Glaucoma eye drops, see the inside back cover of this booklet (National Eye Institute, 2016).

2. **Laser Trabeculoplasty**: Laser trabeculoplasty helps fluid drain out of the eye. Patient`s doctor may suggest this step at any time. In many cases, patient will need to keep taking Glaucoma medicines after this procedure.

Laser trabeculoplasty is performed in patient`s doctor's office or eye clinic. Before the surgery, numbing drops are applied to patient`s eye. As patient sit facing the laser machine, patient`s doctor holds a special lens to patient`s eye. A high-intensity beam of light is aimed through the lens and reflected onto the meshwork inside patient`s eye. Patient may see flashes of bright green or red light. The laser makes several evenly spaced burns that stretch the drainage holes in the meshwork. This allows the fluid to drain better.

Like any surgery, laser surgery can cause side effects, such as inflammation. Patient`s doctor may give patient some drops to take home for any soreness or inflammation inside the eye. Patient will need to make several follow-up visits to have patient`s eye pressure and eye monitored.

If patient have Glaucoma in both eyes, usually only one eye will be treated at a time. Laser treatments for each eye will be scheduled several days to several weeks apart.

Studies show that laser surgery can be very good at reducing the pressure in some patients. However, its effects can wear off over time. Patient`s doctor may suggest further treatment (National Eye Institute, 2016).

3. **Conventional Surgery:** Conventional surgery makes a new opening for the fluid to leave the eye. Patient`s doctor may suggest this treatment at any time. Conventional surgery often is done after medicines and laser surgery has failed to control pressure.

Conventional surgery, called trabeculectomy, is performed in an operating room. Before the surgery, patient is given medicine to help patient relax. Patient`s doctor makes small injections around the eye to numb it. A small piece of tissue is removed to create a new channel for the fluid to drain from the eye. This fluid will drain between the eye tissue layers and create a blister-like "filtration bleb."

For several weeks after the surgery, patient must put drops in the eye to fight infection and inflammation. These drops will be different from those patient may have been using before surgery.

Conventional surgery is performed on patient eye at a time. Usually the operations are four to six weeks apart.

Conventional surgery is about 60 to 80 percent effective at lowering eye pressure. If the new drainage opening narrows, a second operation may be needed. Conventional surgery works best if patient have not had previous eye surgery, such as a cataract operation.

Sometimes after conventional surgery, patient`s vision may not be as good as it was before conventional surgery. Conventional surgery can cause side effects, including cataract, problems with the cornea, inflammation, infection inside the eye, or low eye pressure problems. If patient have any of these problems, tell patient`s doctor so a treatment plan can be developed (National Eye Institute, 2016).

1.5.7 Other forms of Glaucoma

Open-angle Glaucoma is the most common form. Some people have other types of the disease.

1. **Low-tension** or **normal-tension Glaucoma**, optic nerve damage and narrowed side vision occur in people with normal eye pressure. Lowering eye pressure at

least 30 percent through medicines slows the disease in some people. Glaucoma may worsen in others despite low pressures.

A comprehensive medical history is important to identify other potential risk factors, such as low blood pressure, that contribute to low-tension Glaucoma. If no risk factors are identified, the treatment options for low-tension Glaucoma are the same as for open-angle Glaucoma.

2. In **Angle-closure Glaucoma**, the fluid at the front of the eye cannot drain through the angle and leave the eye. The angle gets blocked by part of the iris. People with this type of Glaucoma may have a sudden increase in eye pressure. Symptoms include severe pain and nausea, as well as redness of the eye and blurred vision. If patient have these symptoms, patient need to seek treatment immediately. This is a medical emergency**.** If patient`s doctor is unavailable, go to the nearest hospital or clinic. Without treatment to restore the flow of fluid, the eye can become blind. Usually, prompt laser surgery and medicines can clear the blockage, lower eye pressure, and protect vision.

3. **Congenital Glaucoma**, children are born with a defect in the angle of the eye that slows the normal drainage of fluid. These children usually have obvious symptoms, such as cloudy eyes, sensitivity to light, and excessive tearing. Conventional surgery typically is the suggested treatment, because medicines are not effective and can cause more serious side effects in infants and be difficult to administer. Surgery is safe and effective. If surgery is done promptly, these children usually have an excellent chance of having good vision.

4. **Secondary Glaucoma** can develop as complications of other medical conditions. For example, a severe form of Glaucoma is called **Neovascular Glaucoma**, and can be a result from poorly controlled diabetes or high blood pressure. Other types of Glaucoma sometimes occur with cataract, certain eye tumors, or when the eye is inflamed or irritated by a condition called Uveitis. Sometimes Glaucoma develops after other eye surgeries or serious eye injuries. Steroid drugs used to treat eye inflammations and other diseases can trigger

Glaucoma in some people. There are two eye conditions known to cause secondary forms of Glaucoma.

5. **Pigmentary Glaucoma** occurs when pigment from the iris sheds off and blocks the meshwork, slowing fluid drainage.

6. **Pseudoexfoliation Glaucoma** occurs when extra material is produced and shed off internal eye structures and blocks the meshwork, again slowing fluid drainage.

1.5.8 Secondary Glaucoma Treatment

Depending on the cause of these Secondary Glaucoma treatment includes

- Medicines,
- Laser surgery
- Conventional Glaucoma Surgery
- Other Glaucoma surgery (American Association for Pediatric Ophthalmology and Strabismus, 2016).

1.5.9 Present Research Condition

Through studies in the laboratory and with patients, NEI is seeking better ways to detect, treat, and prevent vision loss in people with Glaucoma. For example, researchers have discovered genes that could help explain how Glaucoma damages the eye.

NEI also is supporting studies to learn more about who is likely to get Glaucoma, when to treat people who have increased eye pressure, and which treatment to use first (National Eye Institute, 2016).

1.5.10 Responsibilities of Glaucoma Patients

If patient are being treated for Glaucoma, be sure to take patient`s Glaucoma medicine every day. See patient`s eye care professional regularly.

Patient also can help protect the vision of family members and friends who may be at high risk for Glaucoma-African Americans over age 40; everyone over age 60, especially Mexican Americans; and people with a family history of the disease. Encourage them to have a comprehensive dilated eye exam at least once every two years. Remember that lowering eye pressure in the early stages of Glaucoma slows progression of the disease and helps save vision.

Medicare covers an annual comprehensive dilated eye exam for some people at high risk for Glaucoma. These people include those with diabetes, those with a family history of Glaucoma, and African Americans age 50 and older (American Association for Pediatric Ophthalmology and Strabismus, 2016).

1.5.11 Use of Glaucoma Eye drops

If eye drops have been prescribed for treating patient`s Glaucoma, patient need to use them properly, as instructed by patient`s eye care professional. Proper use of patient`s Glaucoma medication can improve the medicine's effectiveness and reduce patient`s risk of side effects.

To properly apply patient`s eye drops, these steps should be followed:

- Wash patient`s hands.
- Hold the bottle upside down.
- Tilt patient`s head back.
- Hold the bottle in patient hand and place it as close as possible to the eye.
- With the other hand, pull down patient`s lower eyelid. This forms a pocket.
- Place the prescribed number of drops into the lower eyelid pocket. If patient are using more than patient eye drop, be sure to wait at least 5 minutes before applying the second eye drop.
- Close patient`s eye OR press the lower lid lightly with patient`s finger for at least 1 minute. Either of these steps keeps the drops in the eye and helps prevent the drops from draining into the tear duct, which can increase patient`s risk of side effects (Boyd, 2015).

1.6 Night Blindness

Night blindness (Nyctalopia) is the inability to see well at night or in poor light. It is not a disease in itself, but rather a symptom of an underlying problem, usually a retina problem. It is common for patients who are myopic to have some difficulties with night vision, but this is not due to retinal disease, but rather to optical issues (Lusby, 2016).

1.6.1 Description

Night blindness, also called Nyctalopia, is a symptom of several different diseases or conditions. All of the possible causes of night blindness are associated with the way in which the eye receives light rays. Light travels through the cornea and lens and lands on the retina at the back of the eye. The retina is composed of photoreceptors. Photoreceptors are specialized nerve cells that receive light rays and convert them into electrical signals, which are then transmitted to the brain, creating an image.

There are two types of photoreceptors, rods and cons. There are three million cons and 100 million rods in each eye. The two different photoreceptors are similar in structure; however, rods have a larger outer segment than cons. The outer segments of photoreceptors contain light-sensitive photopigments which change shape whenever light rays strike them. Rods contain the photopigments retinal and rhodopsin, whereas cons contain retinal and three different opsins. Rhodopsin is only able to discriminate between different degrees of light intensity, whereas the opsins of cons distinguish between light wavelengths in the red, blue, and green ranges. Hence, rods see only black and white, but cons see colors. Also, rods enable the eyes to detect motion and provide peripheral vision.

Rods are responsible for vision in dim light, and cons are responsible for vision in bright light. The rods are spread throughout the retina, but the cons are only in the center of the retina. Vision in dim light or darkness is blurry because of the connections between the photoreceptors and the nerve cells which are linked to the brain. Each rod must share this connection to the brain with several other rods so the brain does not know exactly which rod produced the signal. Alternatively, vision in bright light is sharp because each cone has its own connection to the brain so the brain can determine exactly where on the retina the signal originated.

Another feature of rods is that they must adapt to darkness. This is best exemplified by walking into a dark movie theater. At first, patient can see very little. With time, vision improves and patient is able to discern objects. Ultimately, patient can see moderately well. This dark adaptation process occurs because of the chemical nature of rhodopsin. Rhodopsin is decomposed in bright light making the rods nonfunctional. In darkness, rhodopsin is regenerated faster than it can be decomposed. Dark adaptation takes about 15–30 minutes and, when complete, increases light sensitivity by about 100,000 times (W. Lusby, 2016).

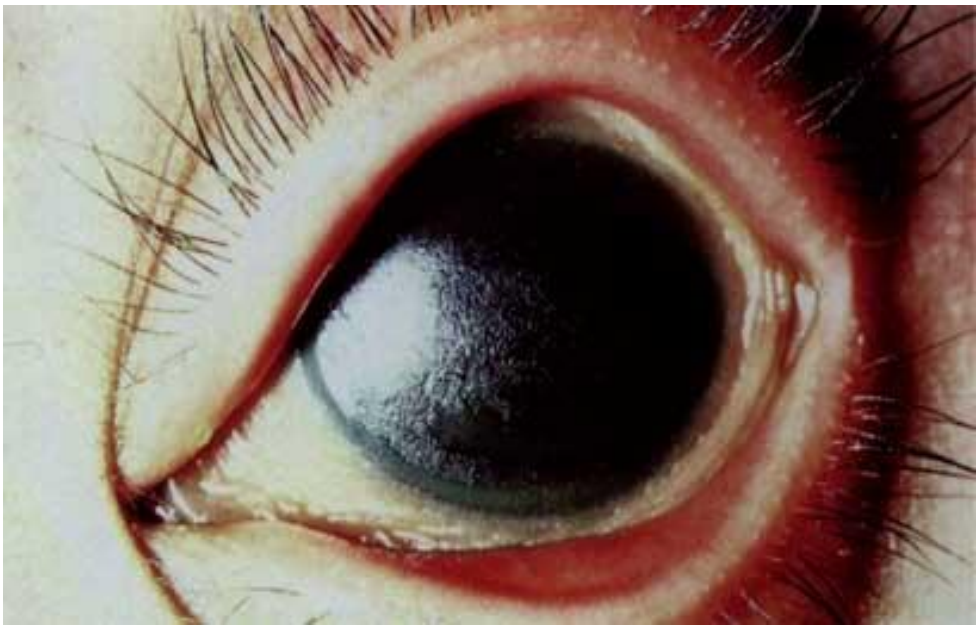

Fig 1.18: Night Blindness Patient Eye (Martin, 2015)

1.6.2 Causes & Symptoms

Several different conditions and diseases can cause night blindness. These include:

1. **Cataracts**: This condition is characterized by a cloudiness of the lens.
2. **Congenital Night Blindness:** This is an inherited, stable disease in which persons suffer from night blindness. Recent advances in gene mapping have identified several mutations responsible for this form of night blindness.
3. **Liver conditions**: Reduced night vision can be linked to poor liver functioning, due to a variety of conditions, which impairs vitamin A metabolism.

4. **Macular Degeneration**: Degeneration of the macula retina, a specialized region of the retina, can cause night blindness.
5. **Retinitis Pigmentosa**: This is an inherited eye disease in which there is progressive deterioration of the photopigments of the photoreceptors, eventually resulting in blindness. The rods are destroyed early in the course of disease resulting in night blindness. Night blindness in children may be an early indicator of retinitis pigmentosa. Recent genetic studies have identified mutations related to retinitis pigmentosa on human chromosome 19.
6. **Vitamin A deficiency:** Night blindness is commonly caused by a deficiency in vitamin A, in fact, it is patient of the first indicators of vitamin A deficiency.
7. **Xerophthalmia**: This condition is characterized by dryness of the conjunctiva (the membrane that covers the eyelids and exposed surface of the eye) and cornea, light sensitivity, and night blindness. It is caused by vitamin A deficiency. Xerophthalmia rarely occurs in countries with adequate supplies of milk products.
8. **Zinc deficiency**: Zinc is a mineral that is necessary for vitamin A to improve vision (Leroy, 2011).

1.6.4 Diagnosis

Night blindness can be diagnosed and treated by an ophthalmologist, a physician who specializes in eye disorders. Opticians can only dispense eye glasses but optometrists may be able to diagnose and treat vision problems.

Diagnosis begins with a detailed medical history regarding the night blindness. Questions include: severity of night blindness, when night blindness began, did it occur gradually or suddenly, etc. An eye examination is performed. A slit lamp examination, in which a narrow beam of intense light is used to examine the internal components of the eye, may also be performed. Additional testing may be performed based upon the results of these standard tests (National Eye Institute, 2012).

1.6.5 Treatment

Changes in vision should never be taken lightly. Because night blindness can be a symptom of a serious disease, an ophthalmologist should be consulted before a person embarks on self-treatment.

Persons who experience night blindness should not drive during the evening or at night. Additional safety precautions should be taken. Alternative remedies may be effective at reducing night blindness, particularly when caused by a vitamin A deficiency (Leroy, 2011).

1.6.5.1 Food Remedies and Supplements

Because night blindness can be caused by a vitamin A deficiency, supplementation with vitamin A, or eating foods rich in vitamin A, may help reduce symptoms. Vitamin A was found to slow the progression of retinitis pigmentosa. Foods rich in vitamin A include dairy products, egg yolks, fish liver oil, and liver. Pregnant women should consult a physician before taking vitamin A supplements because of the link between this vitamin and birth defects.

Vitamin A in humans is primarily obtained by conversion of beta-carotene, a pigment found in fruits and vegetables. Food sources for beta-carotene include apricots, asparagus, broccoli, brussel sprouts, cantaloupe, carrots, cherries, kale, lettuce, mango, mustard greens, papaya, peaches, pumpkin, red cabbage, seaweed, spinach, sweet potatoes, watermelon, winter squash, and yams.

Zinc is necessary to transport vitamin A from the liver to the retina, so zinc supplementation (up to 25 mg daily) may help improve night vision. Docosahexaenoic acid (DHA) helps to increase rhodopsin levels and lines the photoreceptor cells of the retina. DHA is converted from omega-3 fatty acids, both of which are found in certain fish oils. The suggested daily dose of DHA (from fish oils) is 500–1000 mg (National Eye Institute, 2012).

1.6.5.2 Herbal Remedies

Herbals which may improve night vision include:

- Bilberry (*Vaccinium myrtillus*)
- Blueberry (*Vaccinium*) juice
- Dandelion (*Taraxacum officinale*)
- Eyebright (*Euphrasia officinalis*)
- Matrimony vine berries (*Lycii fructus*, kou chi tza)
- Passionflower (*Passiflora incarnata*)
- Queen Anne's lace (*Daucus carota sativas*)
- Rose (*Rosa* species) flower eye wash
    - Yellow dock (*Rumex crispus*) leaves (Rowland and Frey, 2005).

1.6.5.3 Colored Light Therapy

Patient researcher found that some persons have reduced levels of photocurrent transmission (transmission of light signals from the eye to the brain) which can cause, among other things, night blindness. Colored light therapy, in which colored light stimulates the brain, can reduce night blindness caused by this photocurrent deficit. In colored light therapy, patients look at a device those cycles through 11 wave bands of color. Treatment involves 25–30 sessions over a period of four to six weeks (Rowland and Frey, 2005).

1.6.5.4 Allopathic Treatment

Night blindness caused by vitamin A deficiency will be treated with vitamin A supplements. Night vision devices are available which collect and magnify tiny amounts of light to help persons with night blindness see as well as they can during daylight.

Vitamin A supplementation may slow the progress of retinitis pigmentosa. There is no cure for retinitis pigmentosa or macular degeneration, but there are treatments, including laser surgery and the drug thalidomide, which slow down the growth of blood vessels. Cataracts require surgery (Rowland and Frey, 2005).

1.6.6 Expected Results

Vitamin A can effectively treat night blindness in persons who have a deficiency of this nutrient (Rowland and Frey, 2005).

1.6.7 Prevention

Vitamin A may prevent night blindness and slow the progression of eye conditions, such as macular degeneration, which cause night blindness. Wearing sunglasses during the day can prevent eye damage (Rowland and Frey, 2005).

1.7 Epidemiology in Bangladesh Perspective

1.7.1 Cataract

Cataract remains the major cause of avoidable blindness in Bangladesh. The national prevalence survey reveals that there are 4,200 cataract cases per million populations and an incidence rate of 840 per million, Current CSR in Bangladesh is considerably below the required level to even manage the incidence. Good quality cataract surgery is essential, not only in terms of benefits to the individual patient, but to increase the uptake of cataract surgery. The cataract surgical rate should be increased to at least 1,500/million population to deal with annual incidence only. There are 550.000 cataract blind people in Bangladesh which can easily be treated with available technology. Implantation of Intra Ocular Lens (IOL) is the best procedure for restoration of sight of a cataract blind person. This requires substantial increase in the CSR to 1500-2000 from existing rate of 957 in next few years. For elimination of cataract backlog a CSR of between 2000 – 2500 is required where as in order to bring cataract blindness under control a CSR between 2500-3000 would be necessary (National Eye Center, 2016).

1.7.2 Night Blindness

The Night Blindness Study in Bangladesh revealed that 31% of the blindness was due to problem with the lens (cataract), and 27% of the blindness was due to problems in the cornea (Vitamin a deficiency). Including Glaucoma (4%) and Aphakia (5%), 67% of the childhood blindness is thus avoidable (preventable or treatable). The study also found that 90% of the childhood blindness was developed within first 5 years of life. The study indicated that an estimated 40,000 children are blind in Bangladesh (National Eye Center, 2016).

1.7.3 Glaucoma

Glaucoma affects a significant number of people and is one of the leading causes for permanent blindness. According to the Bangladesh National Blindness and Low Vision Survey 1.2% of all adult blindness is due to glaucoma. In general, more people are affected by glaucoma than the number of actual glaucoma blind. In a population based epidemiological survey on glaucoma among Bangladeshi adults, it was found that 2.8% of the population aged 35 years and above were suffering from open angle glaucoma and another 11.2% were glaucoma suspect. Thus, in Bangladesh there are about one million people having open angle glaucoma (National Eye Center, 2016).

1.7.4 Diabetic Retinopathy

This is an emerging problem and is likely to get compounded by changing life styles and ageing of the population. The prevalence of diabetic retinopathy among the diabetic patient is 27%. If the condition is diagnosed and treatment initiated early; it can prevent blindness. Available technology with laser treatment can easily help preventing this blinding disease. The current capacity in the country to diagnose and treat diabetic retinopathy is very limited (National Eye Center, 2016).

Chapter 2

Literature Review

2.1 Awareness of Eye Diseases in an Urban Population in Southern India.

A research was conducted by Dandona *et al*. in 1993 to assess the level of awareness of eye diseases in the urban population of Hyderabad in southern India. A total of 2522 subjects of all ages, who were representative of the Hyderabad population, participated in the population-based Andhra Pradesh Eye Disease Study. Of these subjects, 1859 aged >15 years responded to a structured questionnaire on cataract, glaucoma, night blindness and diabetic retinopathy to trained field investigators. Having heard of the eye disease in question was defined as ‘‘awareness’’ and having some understanding of the eye disease was defined as ‘‘knowledge’’. Awareness of cataract (69.8%) and night blindness (60.0%) was moderate but that of diabetic retinopathy (27.0%) was low, while that of glaucoma (2.3%) was very poor. Knowledge of all the eye diseases assessed was poor. Subjects aged 5-30 years were significantly more aware of all eye diseases assessed except night blindness. Multivariate analysis revealed that women were significantly less aware of night blindness. Education played a significant role in awareness of these eye diseases. Study subjects of upper socioeconomic status were significantly more aware of night blindness and those belonging to upper and middle socioeconomic status were significantly more aware of diabetic retinopathy. Muslims were significantly more aware of cataract and less aware of night blindness. The major source of awareness of the eye diseases was a family member/friend/relative suffering from that eye disease. These data suggest that there is a need for health education in this Indian population to increase their level of awareness and knowledge of common eye diseases. Such awareness and knowledge could lead to better understanding and acceptance of the importance of routine eye examinations for the early detection and treatment of eye diseases, thereby reducing visual impairment in this population (Dandona *et al*., 1993).

2.2 Awareness and Knowledge of Common Eye Diseases among the Academic Staff (Non-Medical Faculties) of University of Malaya.

A cross sectional study was conducted by Chew, Reddy and Karina in 2004 to assess the level of awareness and knowledge of common eye diseases (cataract, glaucoma, diabetic retinopathy and refractive errors) among 473 academic staff (non-medical faculties) of University Malaya. The awareness of cataract was in 88.2%, diabetic retinopathy in 83.5%, refractive errors in 75.3% and glaucoma in 71.5% of the study population. The

knowledge about the entire above common eye diseases was moderate, except presbyopia which was poor. Multivariate analysis revealed that females, older people, and those having family history of eye diseases were significantly more aware and more knowledgeable about the eye diseases. Health education about eye diseases would be beneficial to seek early treatment and prevent visual impairment in the society (Chew, Reddy and Karina, 2004).

2.3 Health Literacy of Common Ocular Diseases in Nepal.

Poor health literacy is often a key cause of lack of or delayed uptake of health care services. To assess the health literacy of common ocular diseases, namely cataract, glaucoma, night blindness, trachoma and diabetic retinopathy in Nepal a cross sectional study was conducted by Shrestha *et al*. in 2014. 1741 participants randomly selected from non-triaged attendants in the outpatient queue at Tilganga Institute of Ophthalmology, a semi urban general population of Bhaktapur district of Kathmandu Valley and patients attending rural outreach clinics. Participants responded to trained enumerators using verbally administered, semi structured questionnaires on their awareness and knowledge of cataract, glaucoma, diabetic retinopathy, night blindness, and trachoma. The awareness of cataract across the entire sample was 49.6%, night blindness was 48.3%, diabetic retinopathy was 29%, glaucoma was 21.3% and trachoma was 6.1%. Patients presenting to rural outreach clinics had poorer awareness of cataract, glaucoma, diabetic retinopathy, night blindness and trachoma compared to those from a semi-urban community and an urban eye hospital , Old age was directly associated with poorer awareness of cataract, glaucoma, night blindness, trachoma and diabetic retinopathy. Female gender was associated with lower awareness of cataract, glaucoma, night blindness and trachoma. Literacy was associated with greater awareness of cataract, glaucoma, diabetic retinopathy, night blindness and trachoma. Higher education was significantly associated with greater awareness of cataract, night blindness and trachoma. Multivariate analysis found that the awareness of common ocular diseases was significantly associated with level of education. Similarly, awareness of cataract, glaucoma, trachoma and night blindness was associated with female gender whereas awareness of cataract, night blindness, trachoma and diabetic retinopathy was associated with age but the awareness glaucoma and diabetic retinopathy was associated with camps. The conclusions that were drawn up from the study was that low awareness of

common ocular conditions is associated with factors such as female gender, old age, lower levels of education and rural habitation (Shrestha *et al*., 2014).

2.4 Pattern of Eye Diseases in a Tertiary Hospital in a Suburban Area: A Retrospective Study.

A retrospective study by Murad *et al*. in 2007 carried out in ophthalmology department of International Medical College & Hospital, Gushlia, Tongi, Gazipur for the period of one year from 1st July 2005 to 30th June 2006. Among one thousand seven hundred fifty (n=1750) human subject those who were attended to eye out patient department. This study was carried out to assess the epidemiology of ophthalmology patient served by International Medical College & Hospital (tertiary hospital) in a suburban industrial area. In this retrospective study, total sample size was 1750. Among them male were 52% and female were 48%. The conjunctivitis was 21.94%, Cataract 9.2%, Refractory error 15.2%, Headache 11.09%, Dacryocystitis 6.51% and Blepharitis 3.2% (Murad *et al*., 2007).

2.5 Factors Associated with Awareness, Attitudes and Practices Regarding Common Eye Diseases in the General Population in a Rural District in Bangladesh: The Bangladesh Population-based Diabetes and Eye Study (BPDES).

To assess the awareness, attitudes and practices associated with common eye diseases and eye care utilization in a rural district of Bangladesh a study was conducted by Islam *et al*. and published in 2015. Data were collected using a multilevel cluster random sampling technique from 3104 adults aged 30 years from the Banshgram union with a questionnaire assessing the awareness, attitudes and practice about diabetes and common eye diseases, educational attainment, socio-economic status, and medical history. Participants were aged between 30 and 89 years with a mean (SD) age of 51 (12) years and 65% were female. The majority of participants had heard of cataracts (90%), trachoma (86%) and Night blindness (84%), yet only 4% had heard of diabetic retinopathy (DR), 7% of glaucoma and 8% of Age-related macular degeneration (AMD). However, 58% of participants did not know vision loss could be prevented. Factors associated with lower awareness regarding common eye diseases were increasing age, lack of formal schooling, and lower socio-economic status. A lower proportion (57%) of people with no schooling compared to those who had attained at least secondary school certificate education (72%) reported that they knew that vision loss could be prevented. Overall 51% of people had heard of at least six (67%) out of nine items relating to

awareness of common eye diseases. This included 41% of participants aged 65 years or older compared to 61% of those aged 30–35 years .Only 4% had an eye check at least once a year and higher education and better SES were associated with higher frequency of eye checks. The results showed a large gap between public awareness and treatment practices about common eye diseases. Public health promotion should be designed to address these knowledge gaps (Islam *et al.*, 2015).

2.6 Awareness of Eye Complications and Prevalence of Retinopathy in the First Visit to Eye Clinic among Type 2 Diabetic Patients.

A study was conducted in 2011 by Tajunisah, Wong and Tan to assess the awareness of eye complications and the prevalence of retinopathy, in the first visit to eye clinic, among type 2 diabetic patients attending a tertiary medical center in Kuala Lumpur, Malaysia. An investigator-administered questionnaire was given to 137 patients with diabetes undergoing first time eye screening in the eye clinic. This was followed by a detailed fundus examination by a senior ophthalmologist to assess for presence of retinopathy. Almost 86% of respondents were aware of diabetic eye complications, especially in patients who had achieved tertiary educational level (96.3%). The majority of the patients (78.8%) were referred by their physicians and only 20.4% came on their own initiative. Many of the patients (43.8%) did not know how frequent they should go for an eye check-up and 72.3% did not know what treatments were available. Lack of understanding on diabetic eye diseases (68.6%) was the main barrier for most patients for not coming for eye screening earlier. Despite a high level of awareness, only 21.9% had recorded HbA1c level of <6.5% while 31.4% were under the erroneous assumption of having a good blood sugar control. A total of 29.2% had diabetic retinopathy in their first visit eye testing (Tajunisah, Wong and Tan, 2011).

2.7 Determinants of Glaucoma Awareness and Knowledge in Urban Chennai.

A study was conducted by Ronnie *et al.* in 2009 to assess the awareness and knowledge levels about glaucoma and its determinants in an urban population of Chennai in south India. Chennai glaucoma study (CGS) was a population based prevalence study to estimate the prevalence of glaucoma in a rural and urban south Indian population. A total of 3850 subjects aged 40 years or above participated in the urban arm of CGS. A systematic random sample of 1926 (50.0%) subjects completed a questionnaire that assesses their awareness and knowledge level of glaucoma. Respondents “having heard

of glaucoma" even before they were contacted/recruited for the study were defined as "aware" and respondents having some understanding of the eye disease were defined as "knowledgeable". The results showed that overall 13.5% were aware of glaucoma; the age-gender adjusted rate for awareness was 13.3%. Two clinicians graded knowledge on glaucoma, based on the subject's knowledge of risk factors, definitions and treatment aspects of glaucoma. Overall 8.7% had some knowledge about glaucoma. Among those who had knowledge 0.5% had good knowledge about glaucoma, 4% had fair knowledge and 4.2% had poor knowledge. It was observed that a very good agreement between the clinicians in grading knowledge. Determinants of glaucoma awareness and knowledge were higher levels of education, females, age, religion and family history of glaucoma. The concluded form of study was that Awareness and knowledge about glaucoma was very low among the urban population of Chennai. It was found that younger subjects and men were less aware of glaucoma. Subjects with lower levels of education were less aware and knew less about glaucoma than their counterparts. The study findings stress the need for health education for effective prevention of blindness due to glaucoma (Ronnie *et al.*, 2009).

2.8 Knowledge and Awareness of Age Related Eye Disease among People Over 45 Years of Age in Tehran: A Population-Based Survey.

The purpose of the study conducted by Ziaei *et al.* in 2012 was to determine the general population's knowledge and awareness about cataract, glaucoma and diabetic retinopathy (DR) in Tehran, the most populated and capital city of Iran, in order to assess the need for health education programs. This cross-sectional population-based survey was conducted during 2010 and a structured questionnaire was filled by 5 trained interviewers via telephone conversation for non-institutionalized inhabitants aged 45 years. The phone numbers were selected with a systematic random sampling among different regions of the city after providing sampling frame from the telecommunication center. In each house we only enrolled one person according to the scheduled table with defined sex and age groups. Awareness was defined as having heard about each disease and knowledge was acceptable if participants stated at least a short correct related sentence. Of 1, 084 eligible people including 574 women (53%) and 510 men (47%), 957 subjects completed the interview (response rate=88.3%). Among the participants 60.2% believed visual impairment (VI) has high or very high effect on daily performance. On the contrary, 8.4%, 16.2% and 15.1% said that VI has none, little or

moderate effect, respectively. The percentage of awareness for glaucoma, cataract and DR were 46.6, 82.9% and 86.2% respectively, and 19.2% and 57.3% had knowledge about glaucoma and cataract. Only 22.6%, 77.2% and 41.6% knew that glaucoma, cataract and DR are treatable. Although the majority of people over 45 years of age in the capital city had heard of cataract and DR, the total knowledge about all assessed diseases and their treatment was insufficient (Ziaei *et al*., 2012).

2.9 Knowledge and Awareness of Diabetic Retinopathy amongst Diabetic Patients in Kenyatta National Hospital, Kenya.

The study was conducted by Mwangi and Githinji in 2011 was to find out the knowledge and awareness of diabetic retinopathy among diabetic patients at Kenyatta National Hospital, Diabetic clinic. Diabetic retinopathy usually occurs due to poor of management of diabetes mellitus and lack of knowledge on the complications of diabetes mellitus. Patients were randomly selected and requested to fill questionnaires and for those who were not in a position to fill due to illiteracy or visual disability, the researcher filled the questionnaire for them. Regarding to knowledge and awareness, 83% of the respondents had heard of diabetic eye disease (DED), 60% of those who had heard of DED, knew the relationship between DED and diabetes. Fifty percent of all the respondents went for eye checkups. The results suggest that there is general awareness of diabetic retinopathy amongst a majority of patients (83%); however the results concluded that there is need to increasing awareness amongst diabetic patient (Mwangi and Githinji, 2011) .

2.10 Awareness, Knowledge, and Practice: A survey of Glaucoma in North Indian Rural Residents.

Studies done on the prevalence of glaucoma have reported a high proportion of undiagnosed patients. Late diagnosis is related to increased risk of glaucoma associated with visual disability. Lack of awareness and non-availability of appropriate screening procedures are among the major reasons for non-diagnosis or late diagnosis of glaucoma. The study had been undertaken by Rewri and Kakkar in 2014 to evaluate the level of awareness about glaucoma among the North Indian rural population. A group-administered, questionnaire-based survey, involving 5000 rural residents (aged 20 and above) was conducted through random sampling. The questionnaire was structured to evaluate the level of awareness and knowledge about glaucoma and the effect of gender, education status, and glaucoma diagnosis was also studied. The source of awareness

about glaucoma was also questioned. Of the 5000 individuals enrolled for the survey, responses from 4927 (98.5%) participants, including 3104 males (63%) and 1823 females (37%) were evaluated. A total of 409 (~8.3%) respondents were aware about glaucoma and only 93 (1.89%) were qualified as having knowledge about glaucoma as per the set questionnaire. Education was the only variable significantly correlated with the awareness and knowledge of glaucoma out of the parameters included in this study. Close acquaintance with a glaucoma patient was the most common source of information (Rewri and Kakkar, 2014).

2.11 Awareness and Knowledge of Poor Vision among Students in Taif University.

The objective of the study was to assess the level of awareness and knowledge of problem of poor vision in Taif city among the Taif University students. The study was conducted by Abdulhamid Alghadmdi in 2011 with a total of 1132 students were randomly chosen from all colleges of the university to participate in the study. They were 686 males and 446 females, 41.2% of them are students in colleges for medical and none medical sciences and the rest were students in the rest of colleges of Taif University. The participants were good representatives of the whole university students. They responded to a structured questionnaire on poor vision to trained field investigators (fifth year medical students). Having heard of the eye disease in question was defined as "awareness' and having some understanding of the eye disease was defined as "knowledge". Awareness of poor vision (~90%) was good. Knowledge of all the eye diseases assessed was ~70%. Students in colleges of sciences were significantly more aware of the poor vision problem than students from the other colleges. ~35% of female students and 30% of male students answered don't know when they asked about knowing about poor vision. There is a little difference in knowledge about poor vision among students in different academic years, being more in the last years than in the early years of academic years. The major source of awareness of poor vision was a family member, of the eye diseases was a family member/friend/relative suffering from that eye disease. These data indicated that knowledge of poor vision and its cause and possible prevention is unsatisfactory, and the available data suggest that there was a need for health education in this population to increase their level of awareness and knowledge of common eye diseases. Such awareness and knowledge could lead to better understanding and acceptance of the importance of routine eye examinations for the early detection and treatment of eye diseases, thereby reducing visual impairment in this population (Alghadmdi, 2011).

Significance of the Study

Asia is the world's largest continent, with more than half of the world's population where Bangladesh is one of the most populated areas in the continent. Up to 20 million Asians are estimated to be blind by the World Health Organization (WHO). In Western populations, the epidemiology of visual impairment and its major causes have been well described, and summarized in a series of meta-analyses. But there is a lacking in similar data for our country (Wong, 2006).

According to the latest assessment, cataract is responsible for 51% of world blindness, which represents about 20 million people. Although cataracts can be surgically removed, in many countries barriers exist that prevent patients to access surgery. Cataract remains the leading cause of blindness. As people in the world live longer, the number of people with cataract is anticipated to grow. Cataract is also an important cause of low vision in both developed and developing countries (WHO, 2016).

There are important differences over the past few decades in diagnosis, medical care, socioeconomic factors and other risk factors that influence the prevalence and geographic distribution of diabetes and retinopathy as well. It is estimated that in 2014 diabetic retinopathy accounted for about 5% of world blindness, representing almost 5 million blind. As the incidence of diabetes gradually increases, there is the possibility that more individuals will suffer from eye complications which, if not properly managed, may lead to permanent eye damage (WHO, 2016).

Glaucoma is one of the leading causes of irreversible blindness in developing nations. It is estimated to be the second most prevalent cause of blindness worldwide after cataract (Fraser et al., 2001), causing a similar magnitude of blindness to that resulting from trachoma. Worldwide, glaucoma is now increasingly recognized as a major cause of ocular morbidity that requires urgent attention. This dreaded eye ailment is referred to as the "sneak thief of sight". It has been projected that there will be 60.5 million people with open angle glaucoma (OAG) and angle closure glaucoma (ACG) in 2010, increasing to 79.6 million by 2020, and of these, 74% will have OAG. Glaucoma blindness though known to be medically and surgically irremediable, early detection and treatment can prevent progression of the disease. Some 90% of all glaucoma-related blindness could have been prevented with early and proper treatment. Lack of knowledge and wrong attitude to blindness can cause delay in diagnosis and treatment (Quigley et al, 2006).

Globally, night blindness is estimated to affect 5.2 million preschool-age children and 9.8 million pregnant women which correspond to 0.9% and 7.8% of the population at risk of Vitamin A deficiency, respectively. Low serum retinol concentration (<0.70 µmol/l) affects an estimated 190 million preschool-age children and 19.1 million pregnant women globally. This corresponds to 33.3% of the preschool-age population and 15.3% of pregnant women in populations at risk of VAD, globally. The WHO Regions of Africa and South-East Asia were found to be the most affected by vitamin A deficiency for both population groups (WHO, 2016)

There are several studies conducting and ongoing on awareness and knowledge assessment in different countries around the around the world like India, Iran, Nepal, Kenya, Malaysia etc. In our knowledge there is a lower number of significant works in our country regarding this topic. One of the major reasons for choosing this topic for the study was to identify the current state of knowledge and awareness of the young-adult student population regarding priority eye diseases in our country. The study is to quantify how much knowledge is among the population therefore calculating measures that should be taken to create mass awareness.

Aims and Objective of the Study

The aims and objectives of this study were to:

- To assess the awareness and knowledge levels about Cataract, Glaucoma, Night Blindness and Diabetic Retinopathy.
- To assess the awareness, attitudes, and practices associated with common eye diseases and eye care utilization.

Chapter 3

Methodology

3.1 Type of the Study

It was a survey based study.

3.2 Study Area

The survey was conducted in nine universities in different areas inside Dhaka City. The universities were

1. Dhaka University
2. BUET
3. North South University
4. Stamford University
5. Daffodil University
6. Prime Asia University
7. BGMEA University of Fashion & Technology (BUFT)
8. Shanto-Mariam University of Creative Technology
9. University of Liberal Arts Bangladesh (ULAB)

3.3 Study Population

In this study, a total number of 572 students of different departments were surveyed with a questionnaire in order to assess the awareness and knowledge regarding eye disease. Informed consent was obtained from the eligible participants before interviewed and participants who agreed to join the study provided the required information for the studies.

3.4 Study Period

The duration of the study was about four months starting from January to April in 2016.

3.5 Questionnaire Development

The pre-tested questionnaire was specially designed to collect the simple background data and the needed information. The questionnaire was written in simple English in order to avoid unnecessary semantic misunderstanding. The questionnaire was pilot tested to ensure it was understandable by the participants. Extra space was however, allowed after some questions for the participants' comments; and in most cases, these were used as qualifying remarks which aided considerably in giving answers to specific

questions and in providing additional information which assisted the interviewers in drawing up conclusions.

3.6 Sampling Technique

In this study purposive sampling technique was followed.

3.7 Data Analysis

After collecting, the data were checked and analyzed with the help of Microsoft Excel 2010. The result was shown in bar, pie and column chart and calculated the percentage of the awareness and disease regarding eye disease among the students.

Chapter 4

Result

4.1 Departmental Distribution of the Students

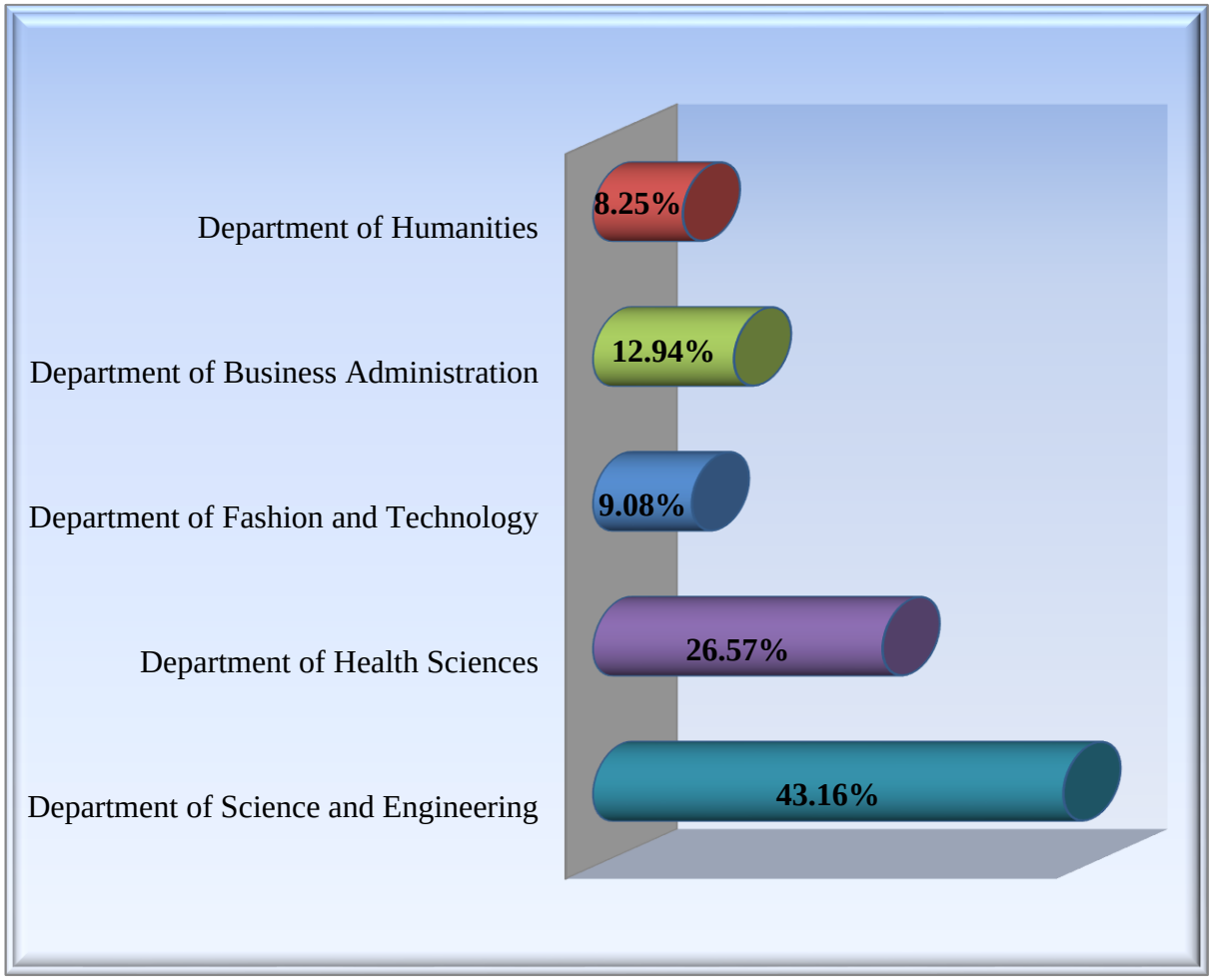

Fig 4.1: Departmental Distribution of the Students

As the whole research work was conducted on university going students, students with multiple disciplinary subjects were participated in the survey. It was found that 43.16% of the students were from department of Science and Engineering which was the highest among all. The second most students were from Health Sciences and their percentage was 26.57%. Other departments include Fashion and Technology, Business Administration and lastly Humanities department.

4.2 Age Distribution of the Students

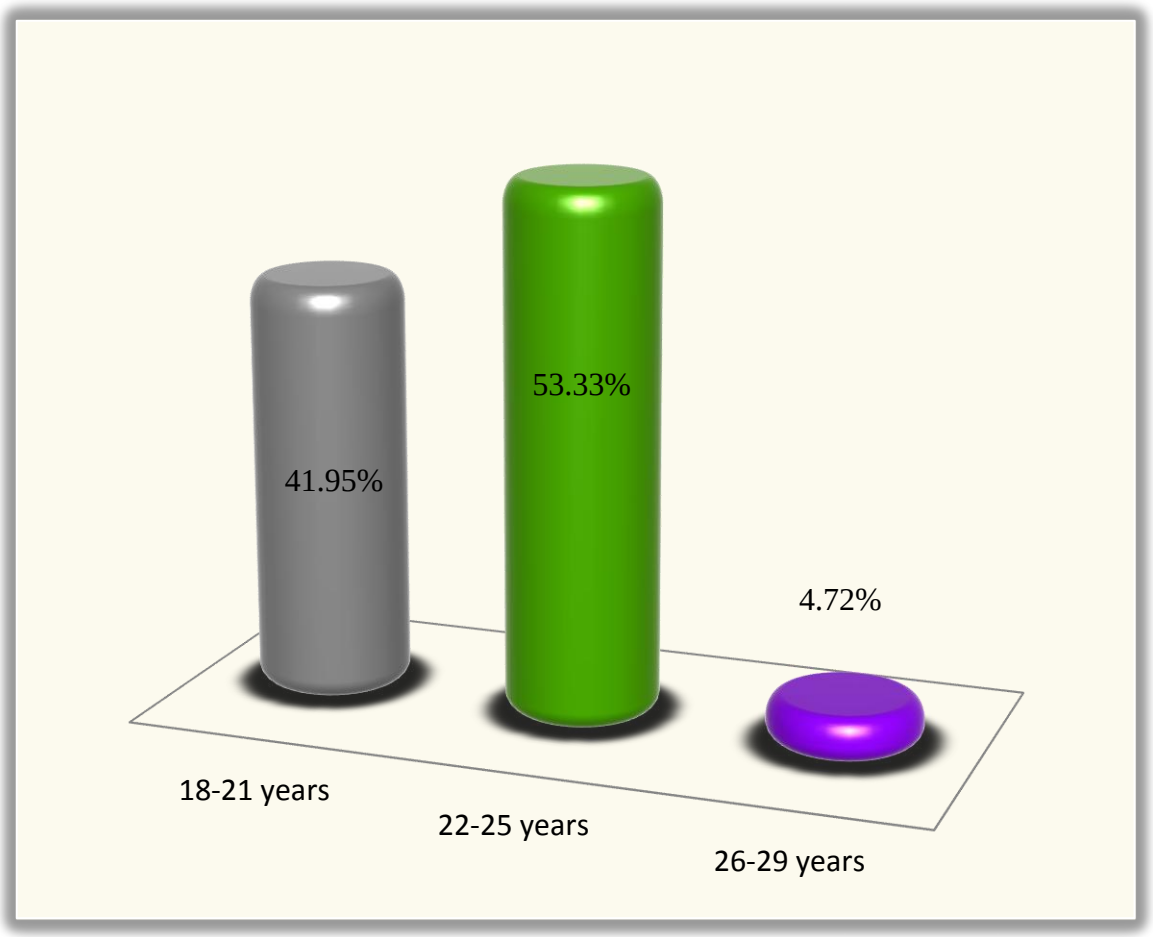

Fig 4.2: Age Distribution of the Students

During this study it was found that about 53.33% were in between 22 to 25 years, whereas, 41.95% of the workers were within the range of 18 to 21 years. However, only 4.72% workers were between 26 to 29 years of age.

4.3 Gender Distribution of the Students

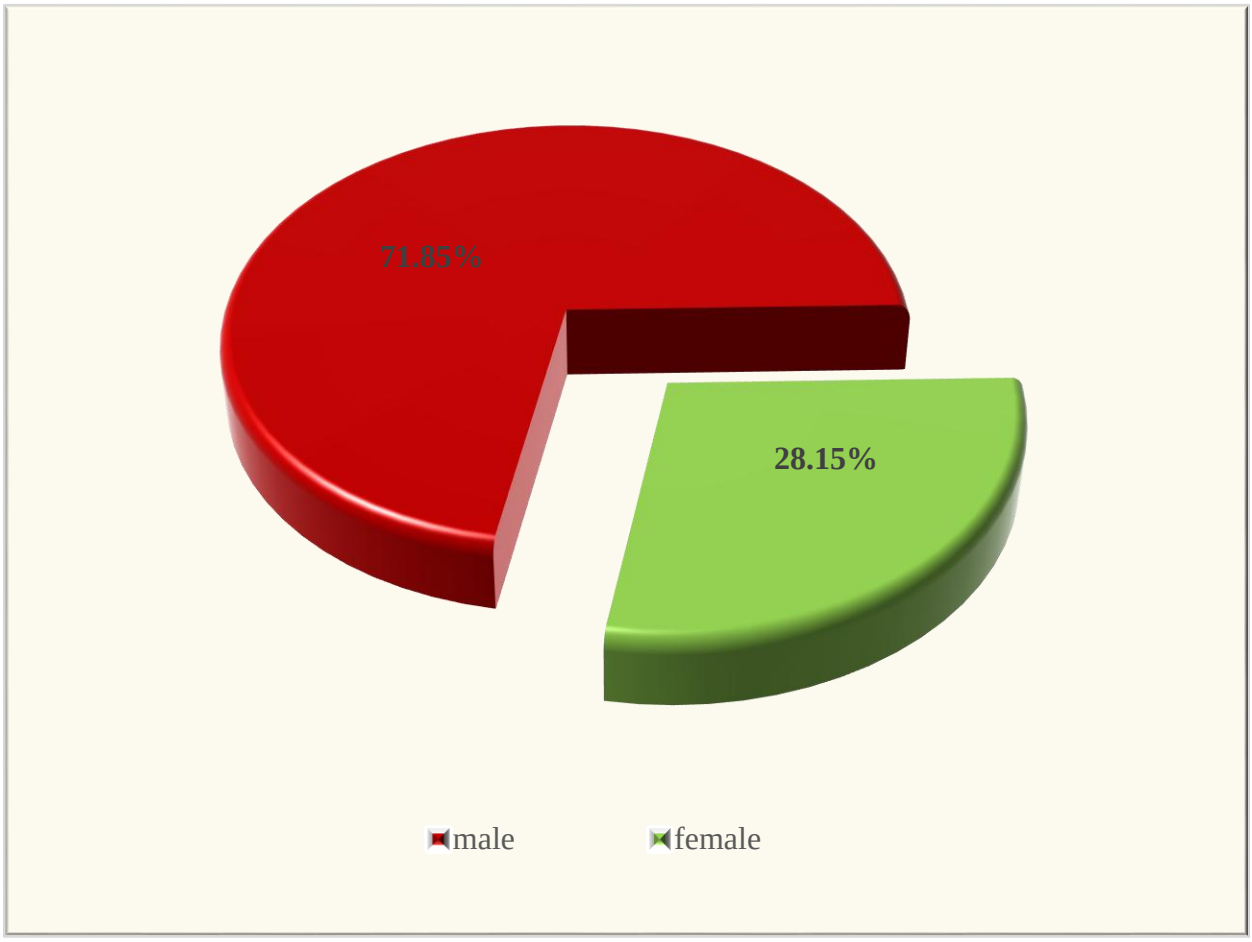

Fig 4.3: Gender Distribution of the Students

From the graphical representation above, it can be concluded that majority of the students were male 71.85% and 28.15% of the students were female.

4.4 Socio-Economic Condition of the Students

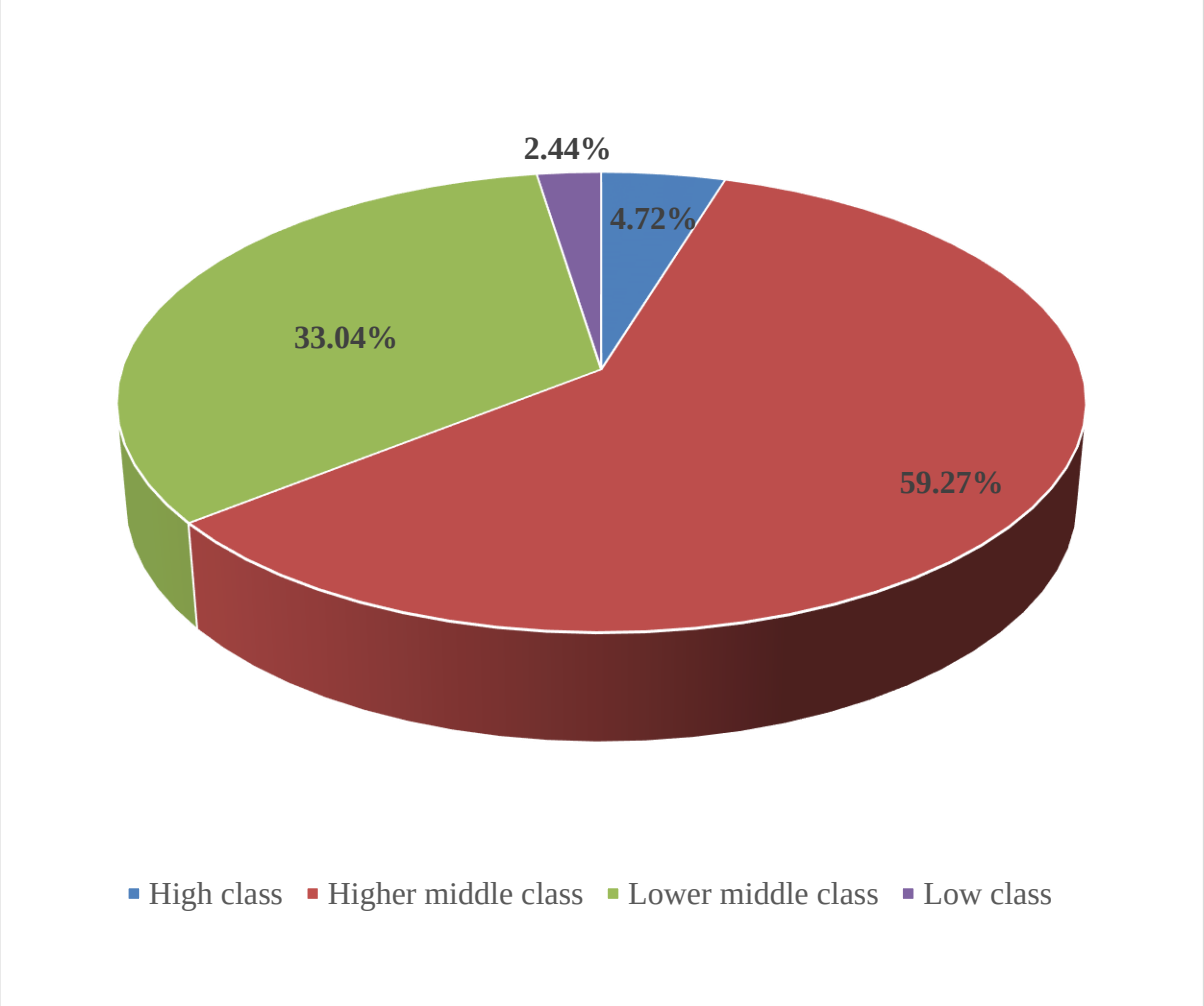

Fig 4.4: Socio-Economic Condition of the Students

It was observed that among 572 students major portion of the students 59.27% belongs to higher middle class. On the other hand, only 2.44% students were from low class family.

4.5 Cataract

4.5.1 Knowledge about Cataract

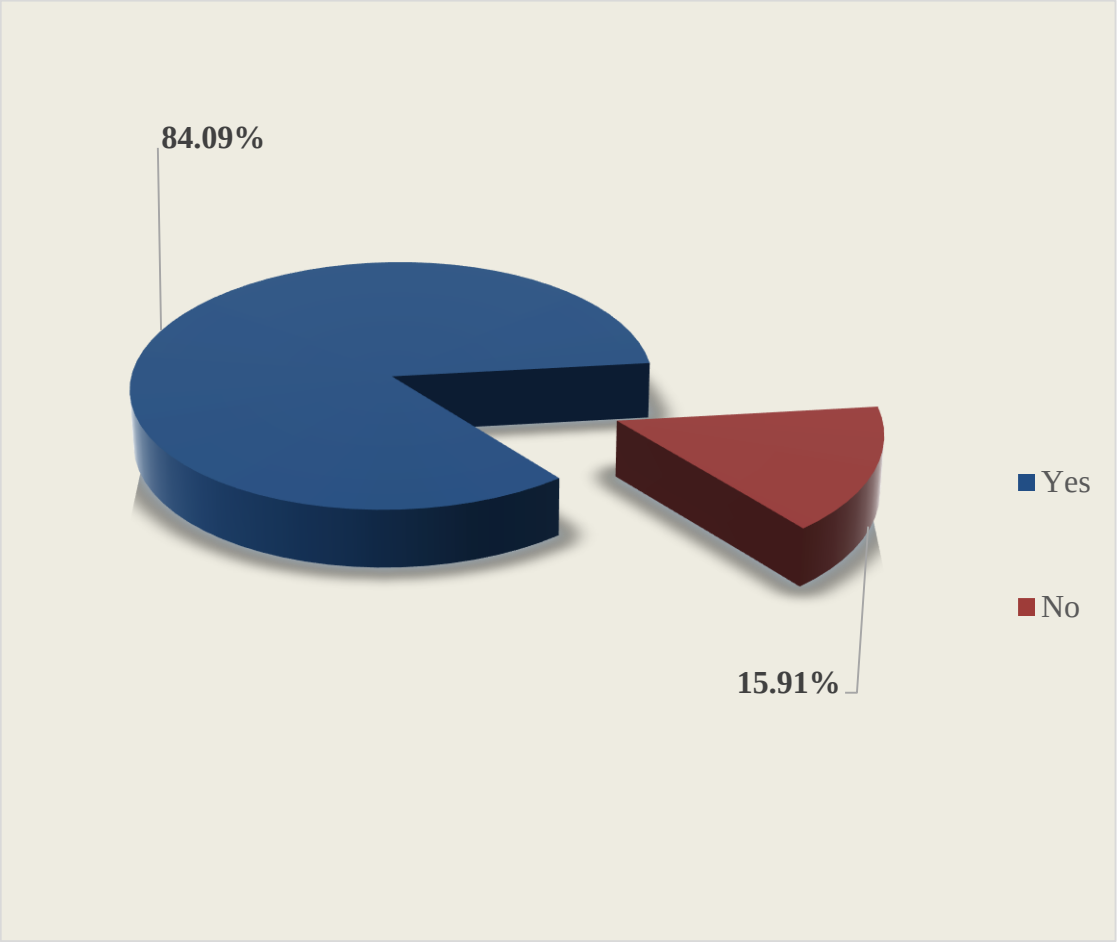

Fig 4.5: Knowledge about Cataract

During the study, 84.09% answered that they have heard about cataract and the remaining 15.91% said that they didn't heard about cataract.

4.5.2 Knowledge about Definition

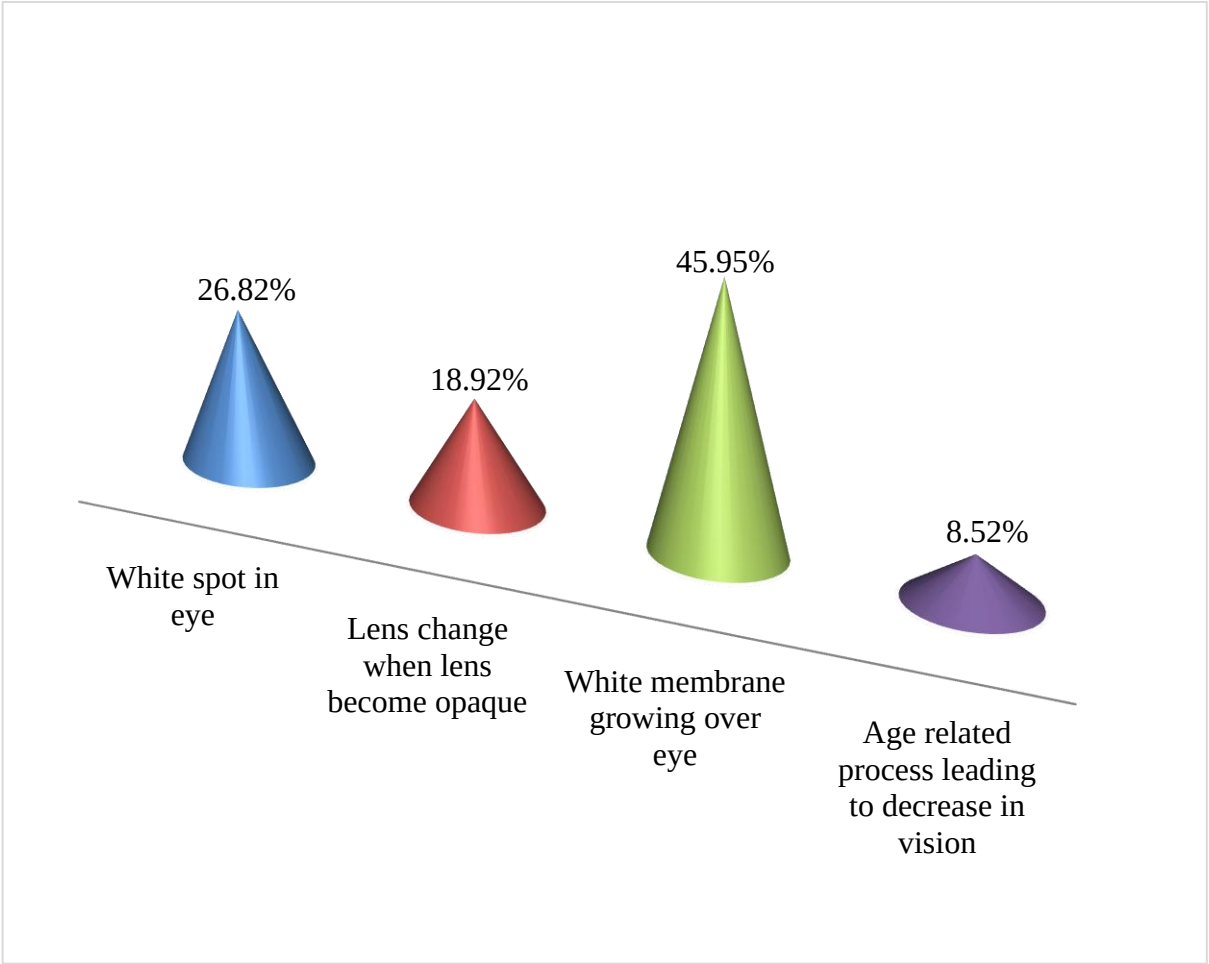

Fig 4.6: Knowledge about Definition

When asked about the definition of Cataract, majority of the students (45.95%) answered that cataract is a white membrane growing over the eye while 26.82% of them said that cataract is a white spot in the eye and only 8.52% students answered cataract as an age related process.

4.5.3 Source of Knowledge

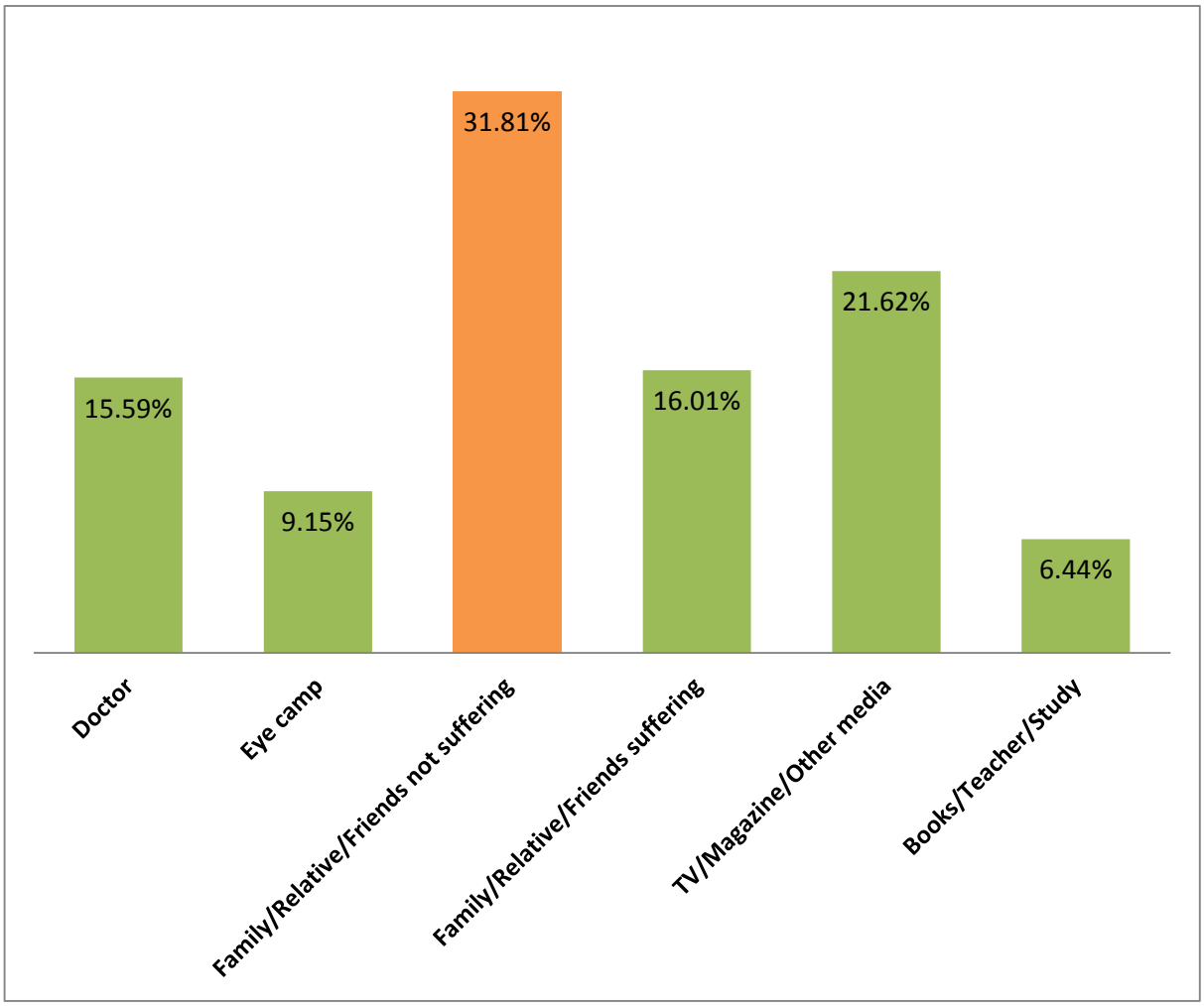

Fig 4.7: Source of Knowledge

As mentioned earlier, 84.09% students knew about cataract. It was observed that for most the student's source of knowledge had been family members/relative/friends not suffering from it (31.81%). Students who came to know about it from TV/Magazine/Other media were highest (21.62%) and remaining (6.49%) students learned from Books/Teachers/Study.

4.5.4 Knowledge about Treatability

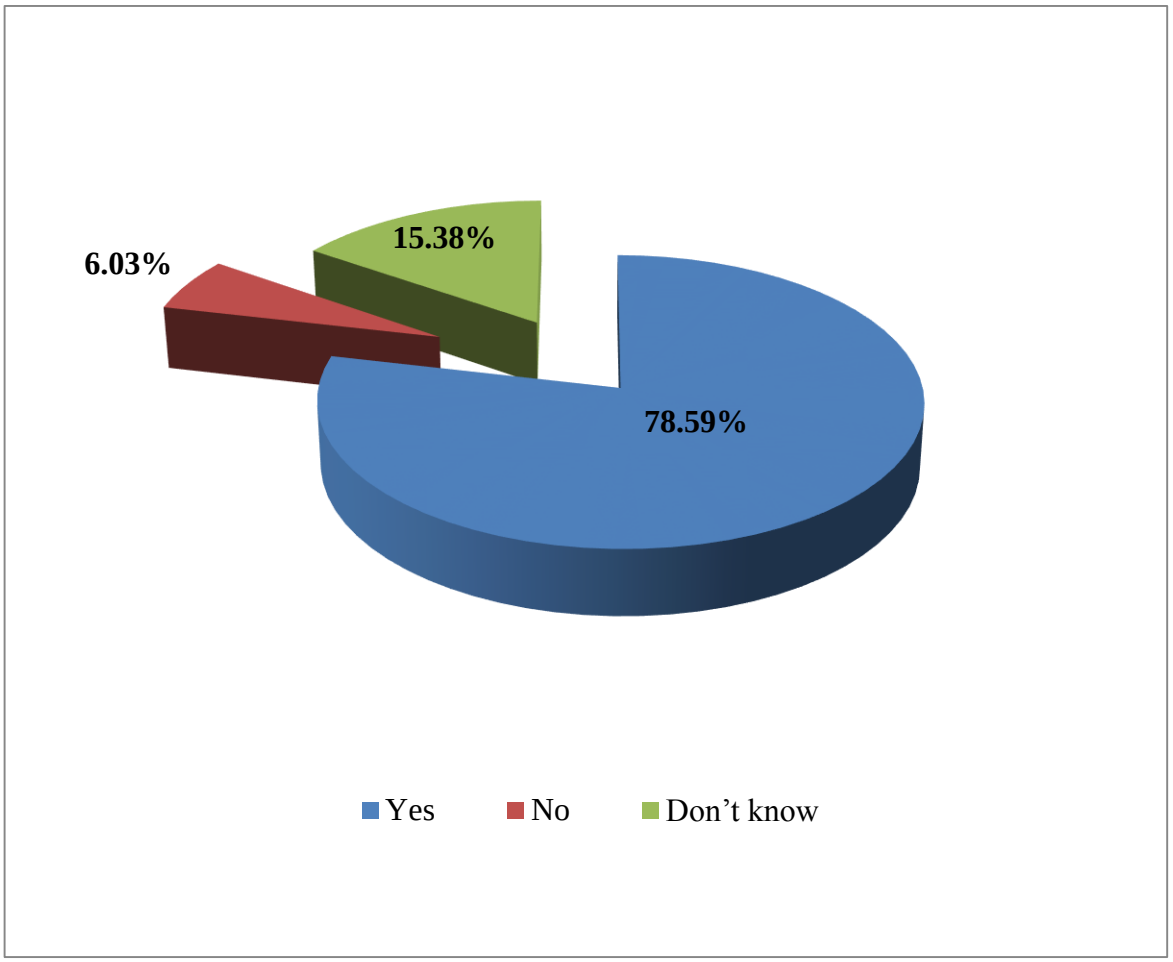

Fig 4.8: Knowledge about Treatability

The selected questionnaire provided the question of that whether Cataract is treatable and 78.59% of the students answered in affirmative whereas 6.03% students thought otherwise.

4.5.5 Knowledge of Cataract Treatment

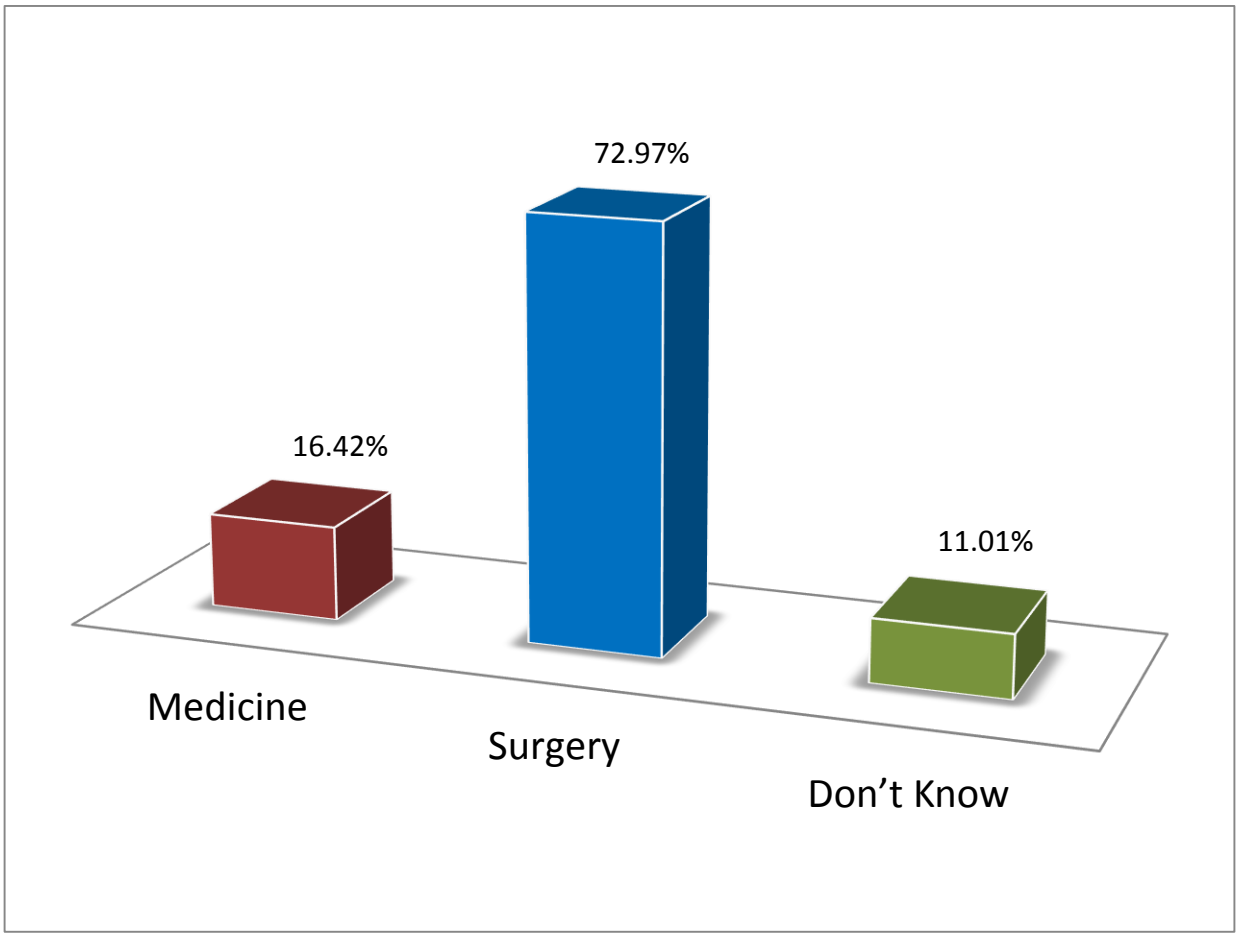

Fig 4.9: Knowledge of Cataract Treatment

When asking about the treatment procedures, majority (72.97%) students said surgery was the treatment for the blindness. On the other hand, 16.42% answered that medication was the treatment for Cataract and lastly 11.01% didn't know anything about it.

4.5.6 Knowledge about Possibility of Getting Vision Back

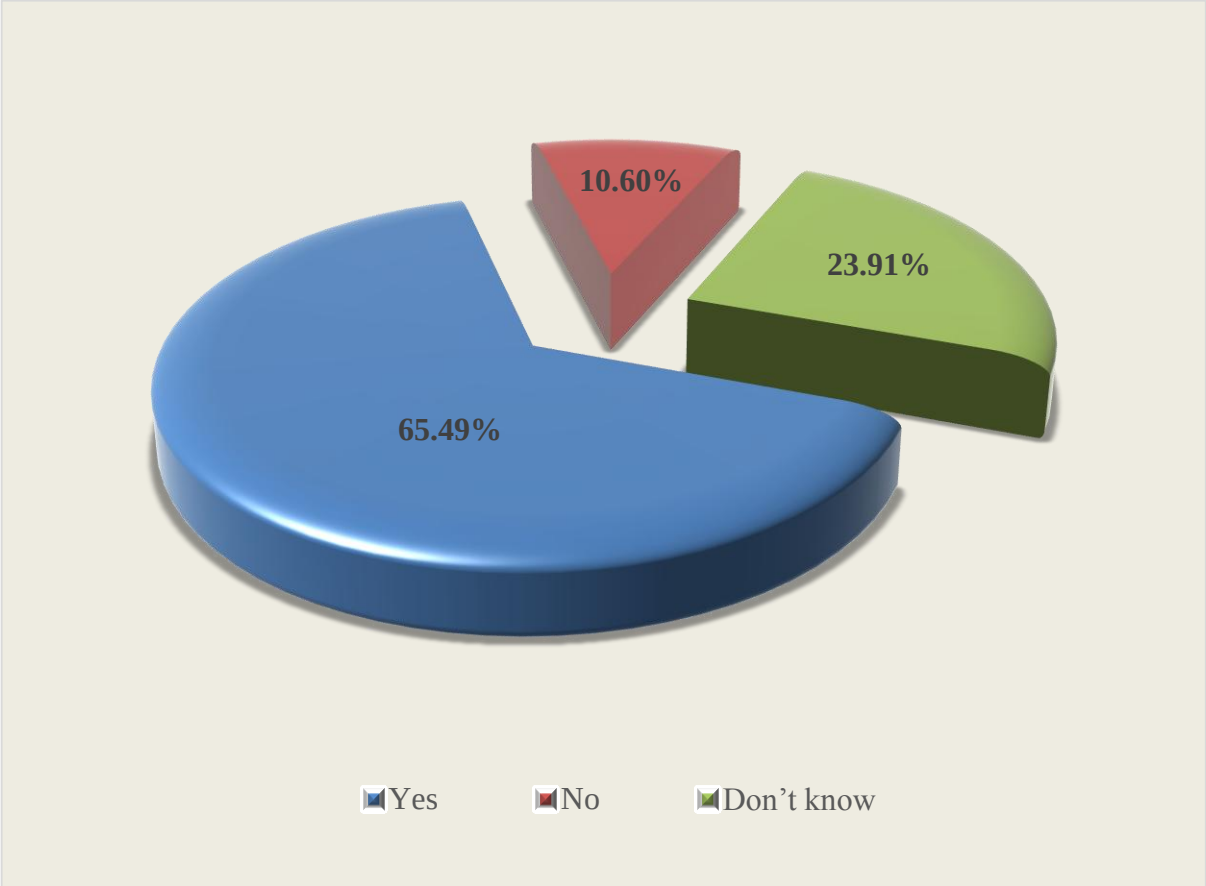

Fig 4.10: Knowledge about Possibility of Getting Vision Back

When asked about the possibility of getting vision back 65.49% of the students answered that they don't think that it was possible to get vision back from cataract blindness and only 10.60% students thought otherwise.

4.5.7 Knowledge about Intraocular Lens Implantation (IOL)

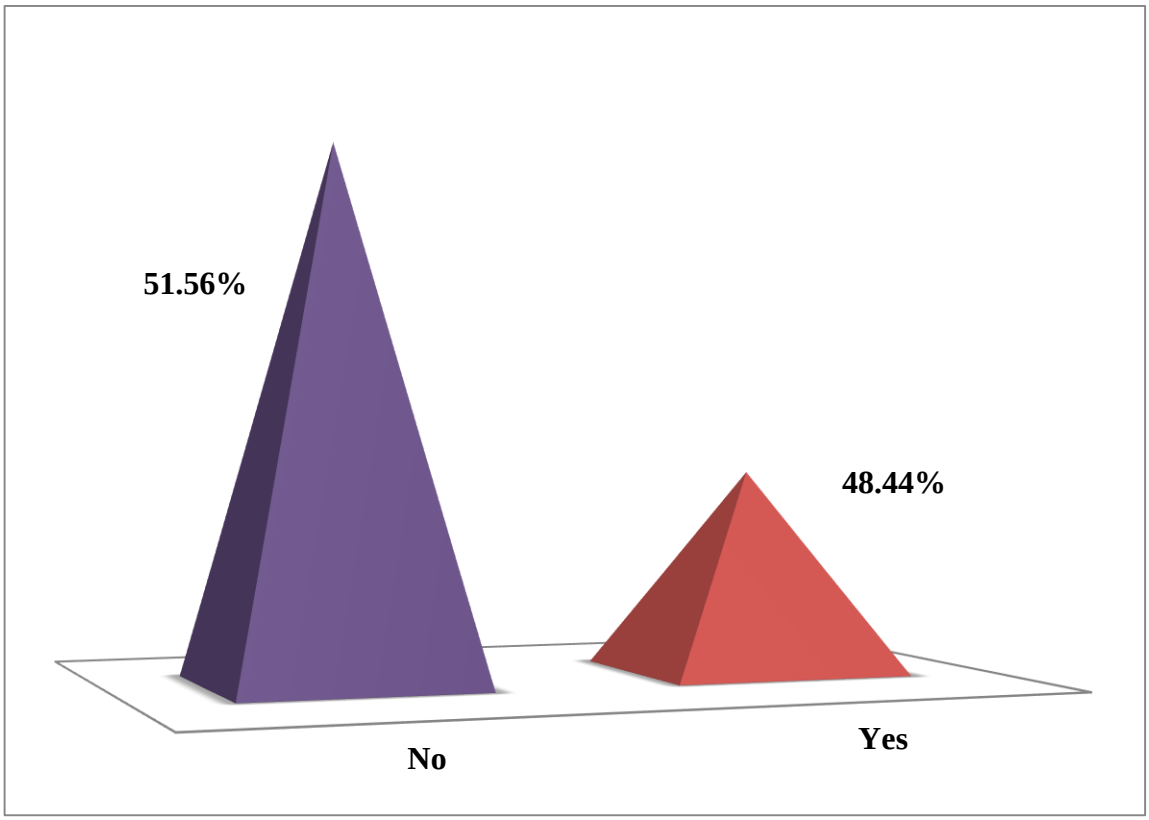

Fig 4.11: Knowledge about Intraocular Lens Implantation (IOL)

It was observed that 48.46% of the students know about Intraocular Lens Implantation and the other 51.56% students didn't know about it.

4.6 Glaucoma

4.6.1 Knowledge about Glaucoma

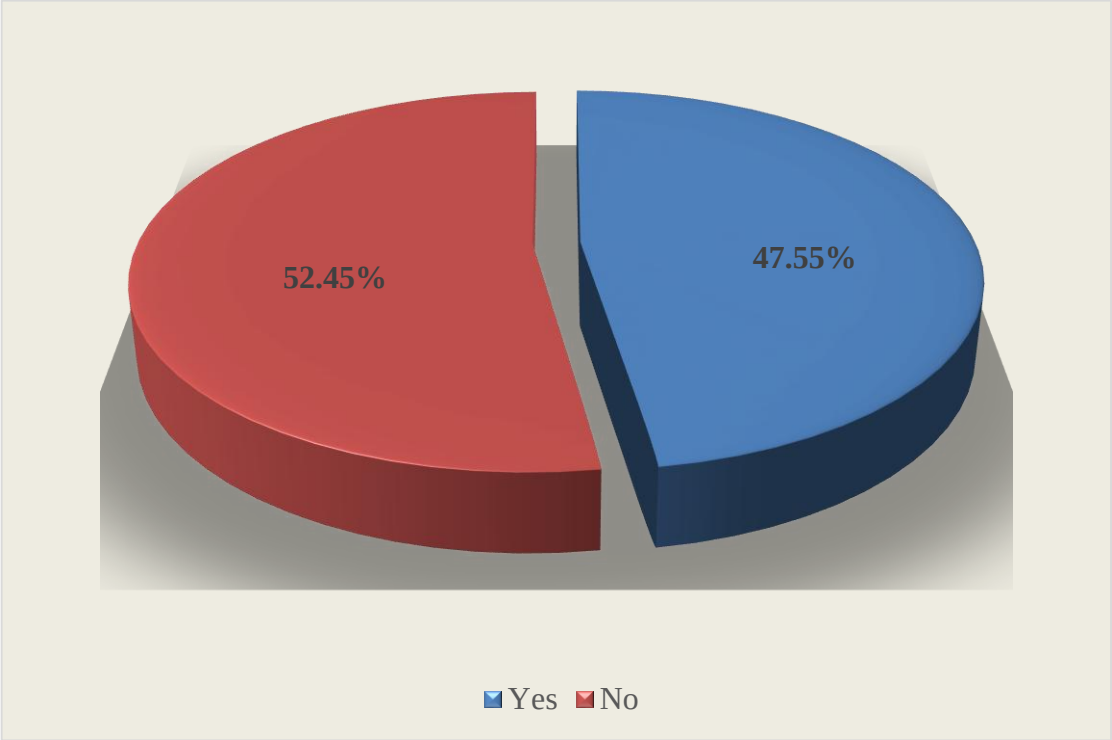

Fig 4.12: Knowledge about Glaucoma

Of the 572 students, majority of them (52.45%) said that they didn't heard about glaucoma and the remaining 47.55% answered that they have heard about it.

4.6.2 Knowledge about the Definition

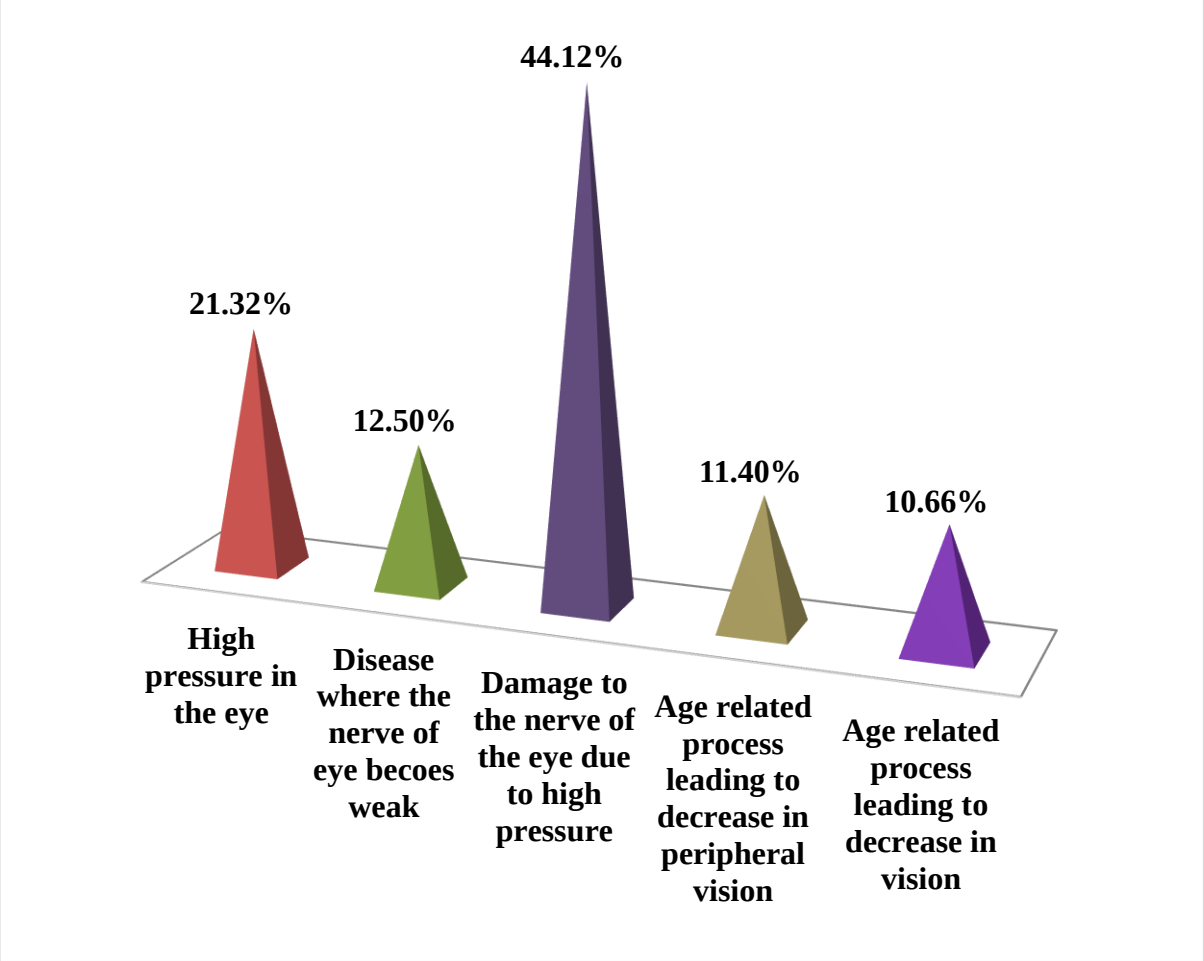

Fig 4.13: Knowledge of Definition

While asking about the definition of glaucoma, 44.12% of the students answered damage to the nerve of the eye due to high pressure, 21.32% said high pressure in the eye and lastly 10.66% said age related process leading to decrease in vision.

4.6.3 Source of Knowledge

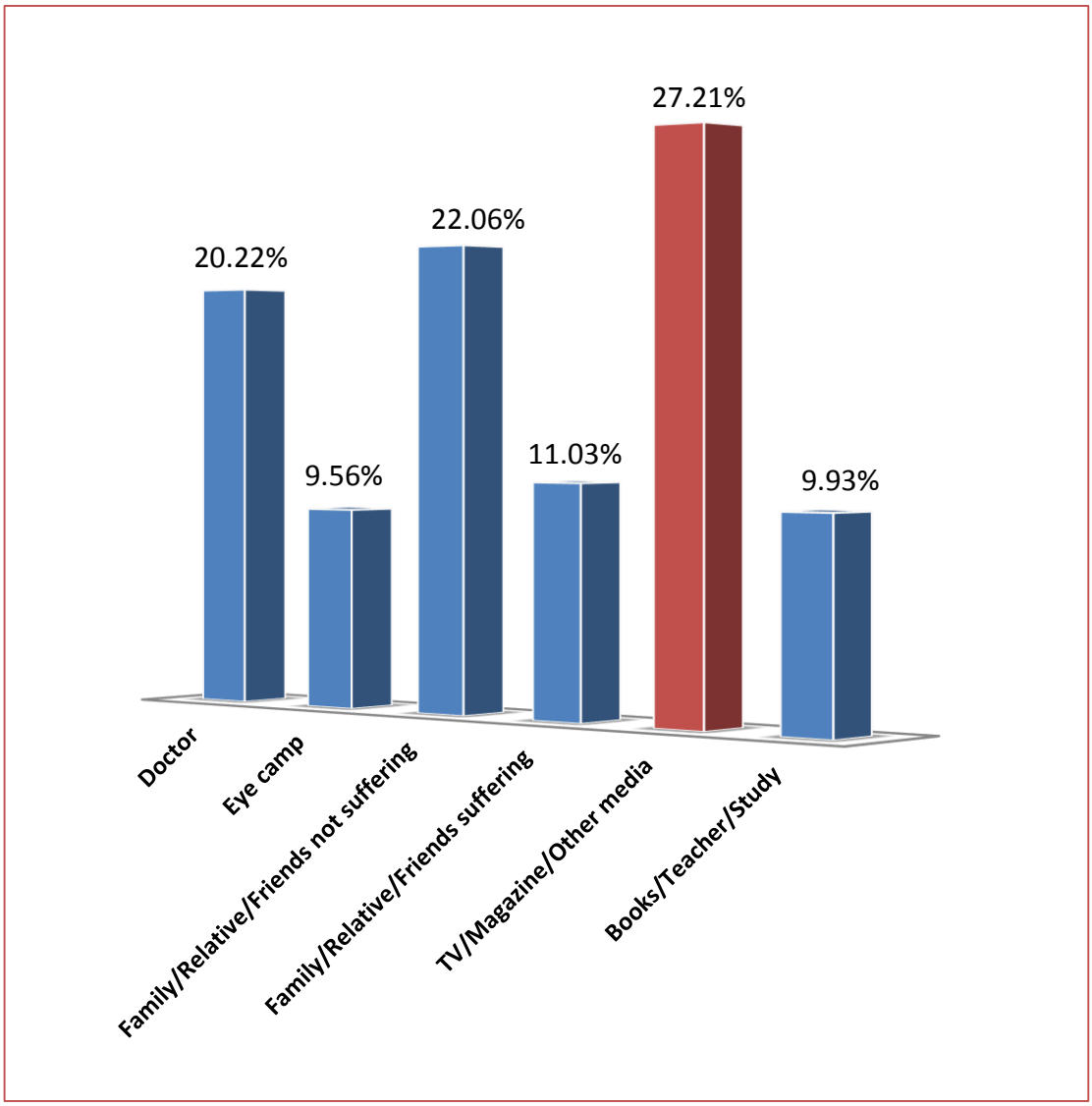

Fig 4.14: Source of Knowledge

Majority of the students (27.21%) knew about glaucoma from TV/Magazine/Other media. Again, 22.06% of them from unaffected Family members/Relative/Friends not suffering from it. Almost 20.22% students answered Doctors as their main source, and 9.56% answered Eye camp as their source of knowledge.

4.6.4 Knowledge about Visual Loss being Permanent/Reversible

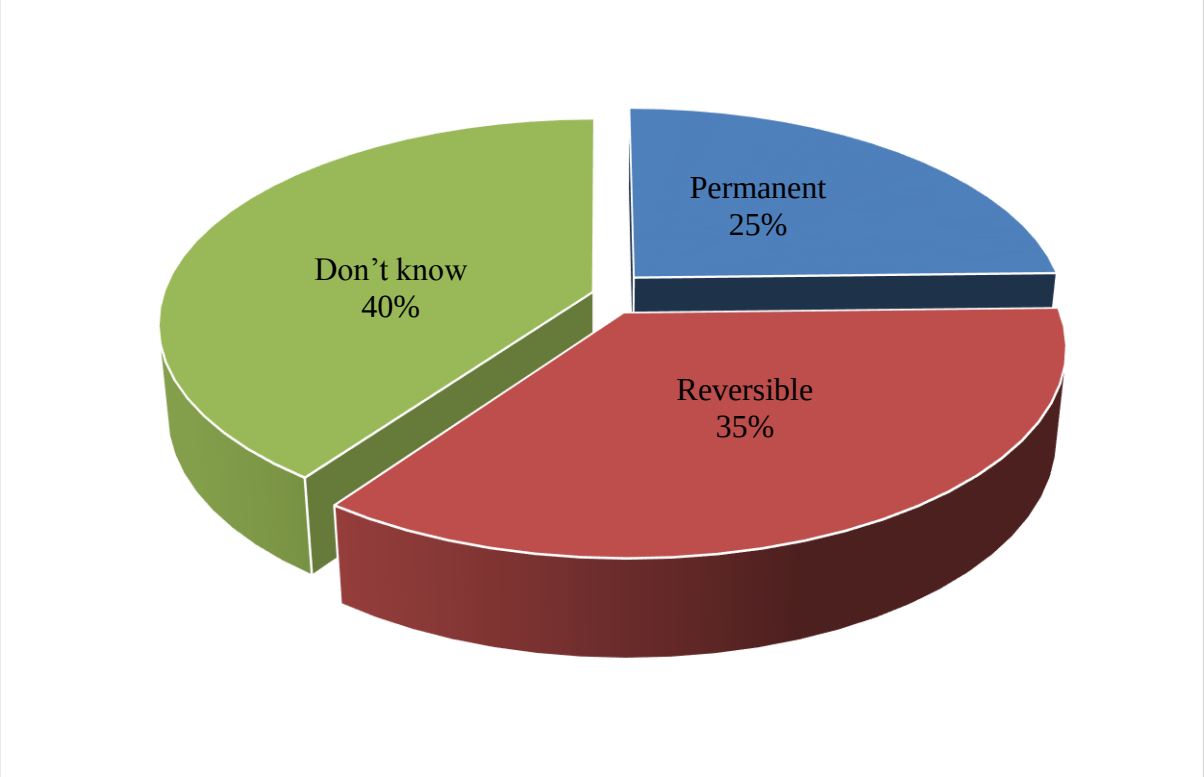

Fig 4.15: Knowledge about Visual Loss being Permanent/Reversible

When asked about visual loss whether reversible or permanent 24.63% of the students answered that visual loss due to glaucoma was permanent and another 35.29% students answered glaucoma as reversible. Whereas 40.07% of the students didn't know anything about it.

4.6.5 Knowledge about Glaucoma Treatment

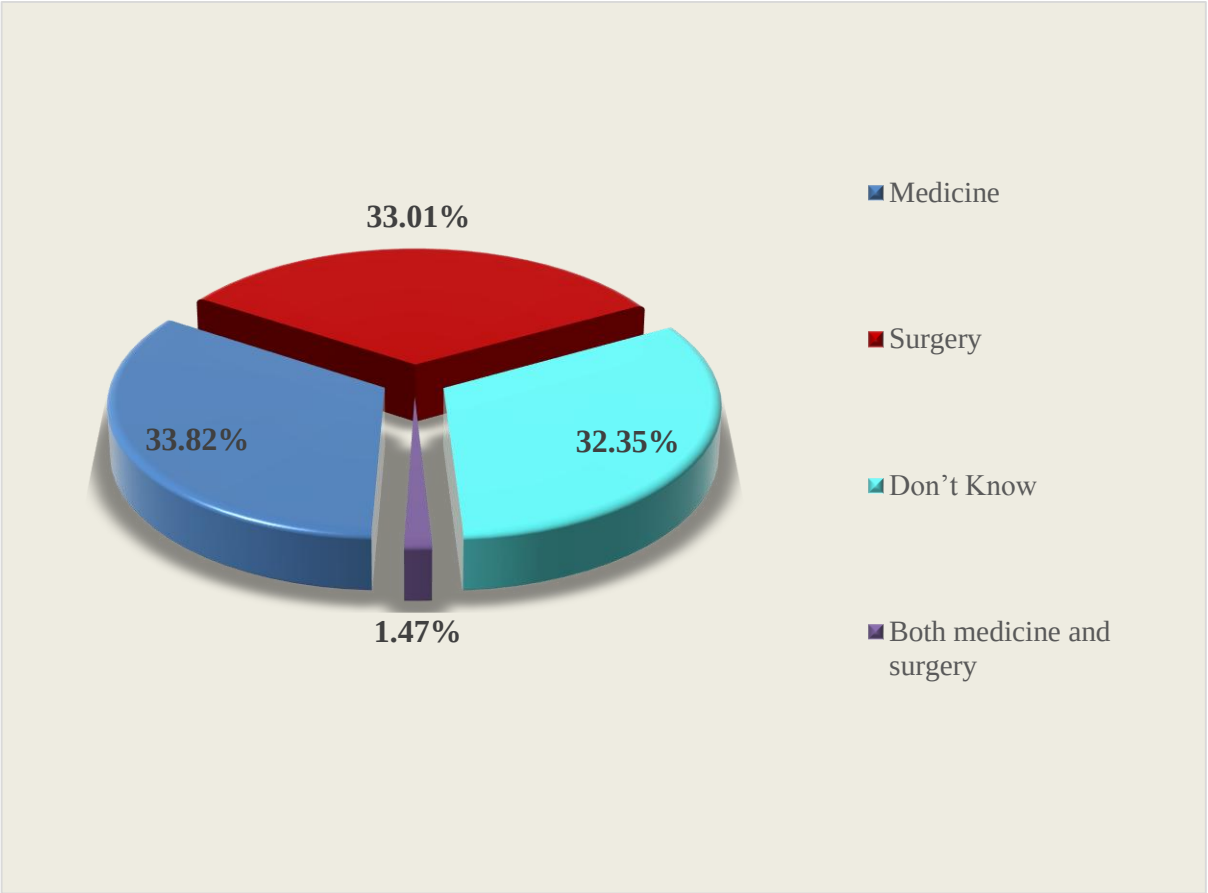

Fig 4.16: Knowledge of Glaucoma Treatment

During the study it was seen that 33.82% thought medication was the treatment for Glaucoma and 33.01% thought it was Surgery. On the other hand, 32.35% didn't know anything regarding this topic.

4.6.6 Possibility of Getting Vision Back From Glaucoma Blindness

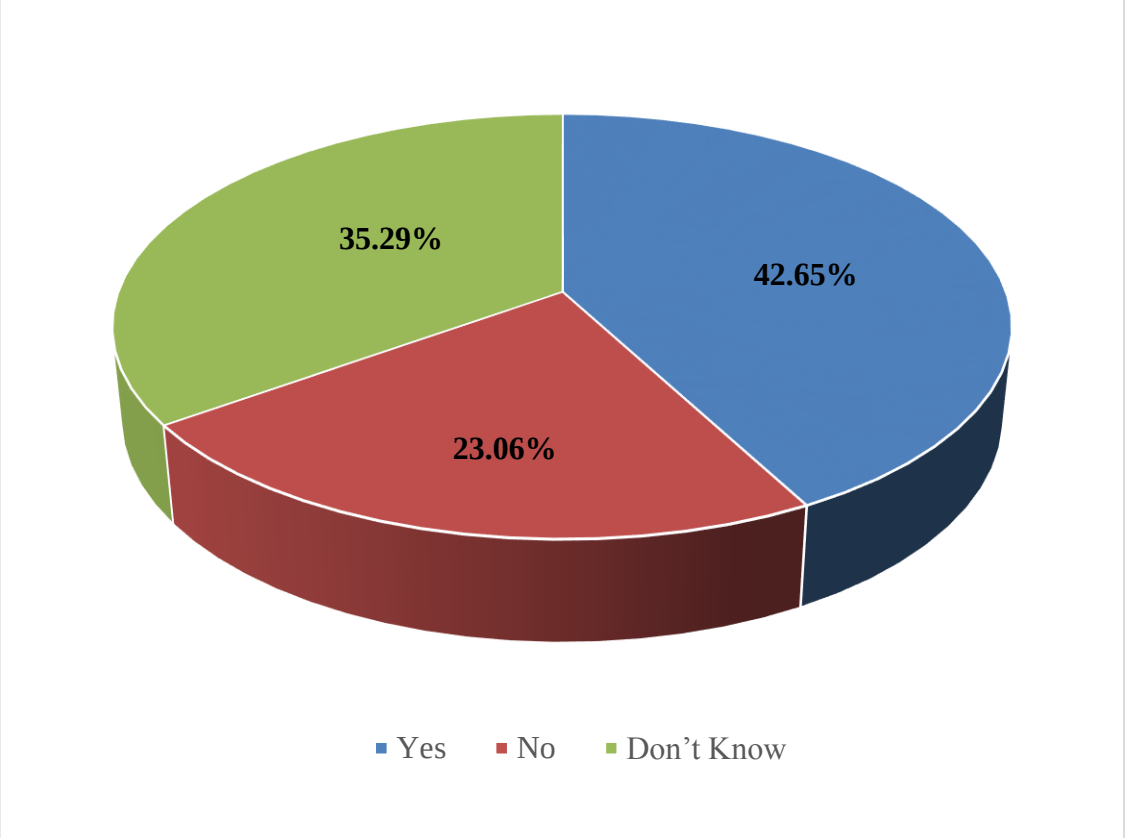

Fig 4.17: Possibility of Getting Vision Back From Glaucoma Blindness

It can be summarized that around 42.65% of the students think that it was possible to get vision back from Glaucoma and 22.06% students thought otherwise.

4.7 Night Blindness

4.7.1 Knowledge about Night Blindness

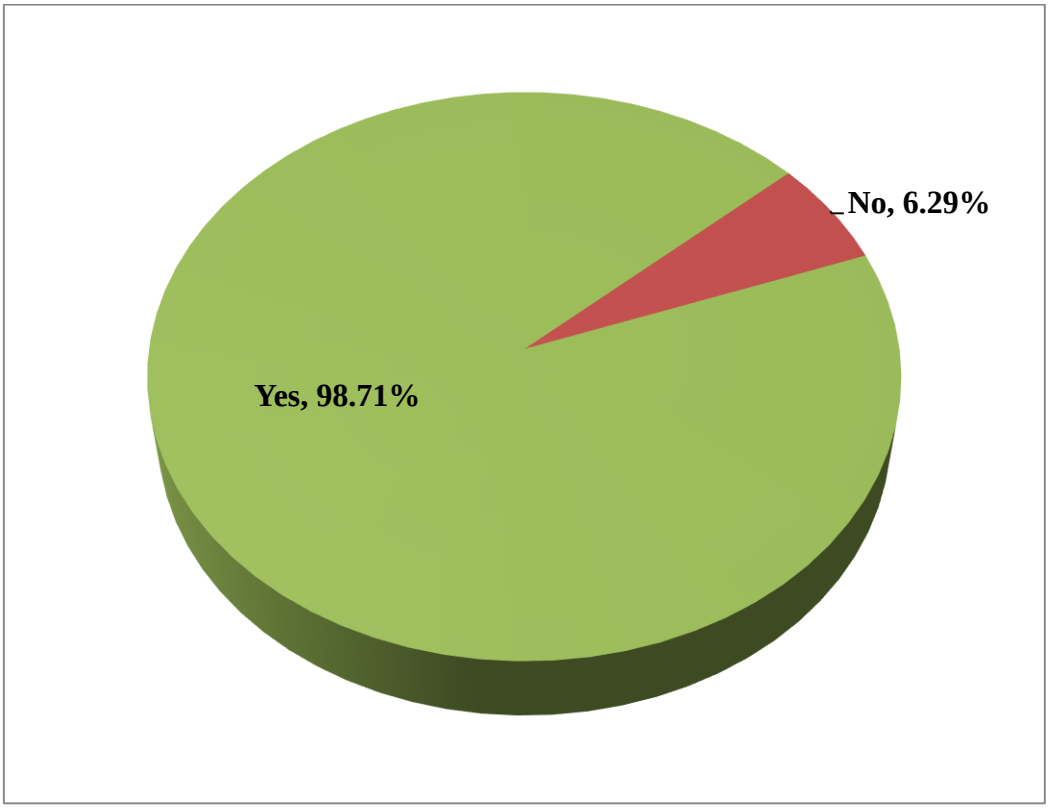

Fig 4.18: Knowledge about Night Blindness

It was observed that among 572 students, 93.71% answered that they have heard about Night blindness and the remaining 6.29% answered in the negative.

4.7.2 Source of Knowledge

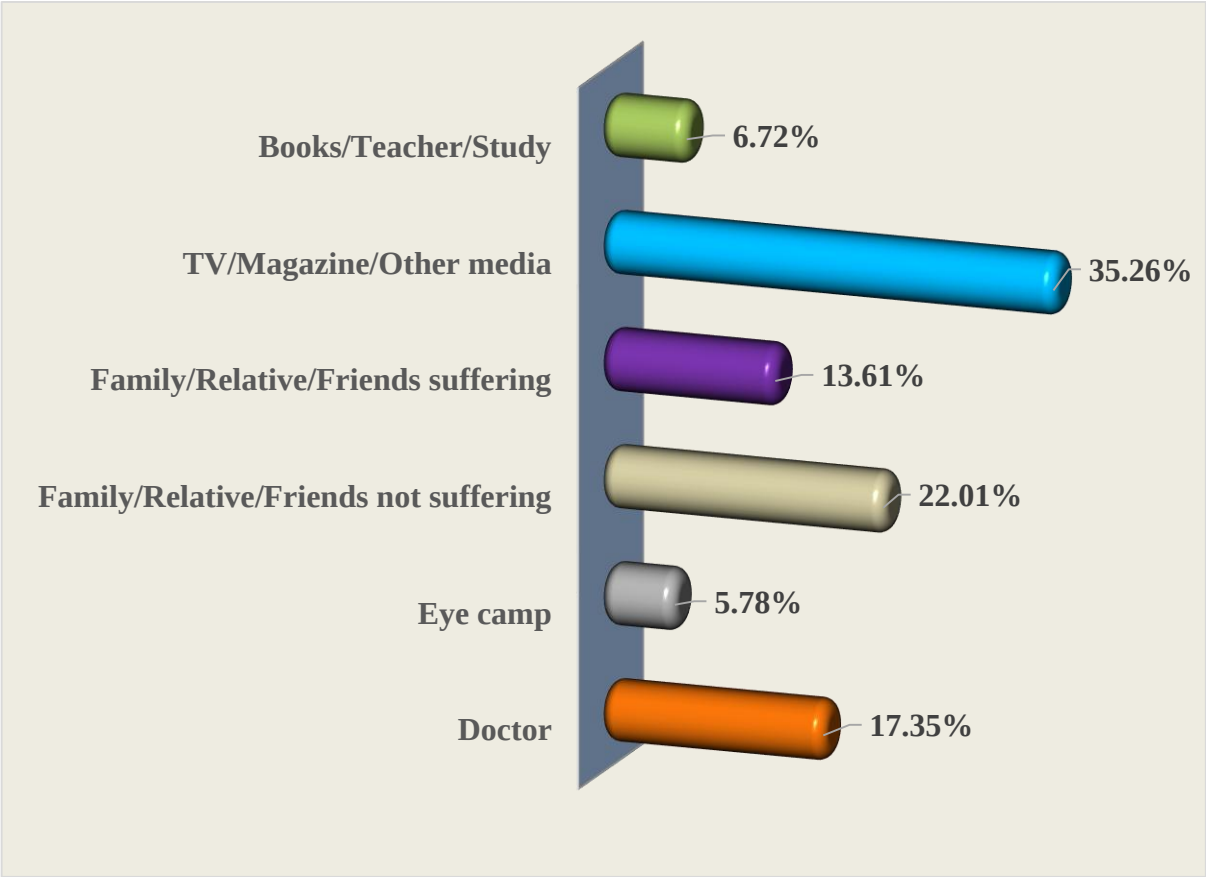

Fig 4.19: Source of Knowledge

During this study, it was observed that highest number of the students (35.26%) came to know about it from TV/Magazine/Other media and 22.01% of them knew about night blindness from Family members/Relative/Friends who were not suffering from it. After that, 17.35% answered Doctors as their source of information, and 5.78% answered Eye camp.

4.7.3 Common Cause of Night Blindness

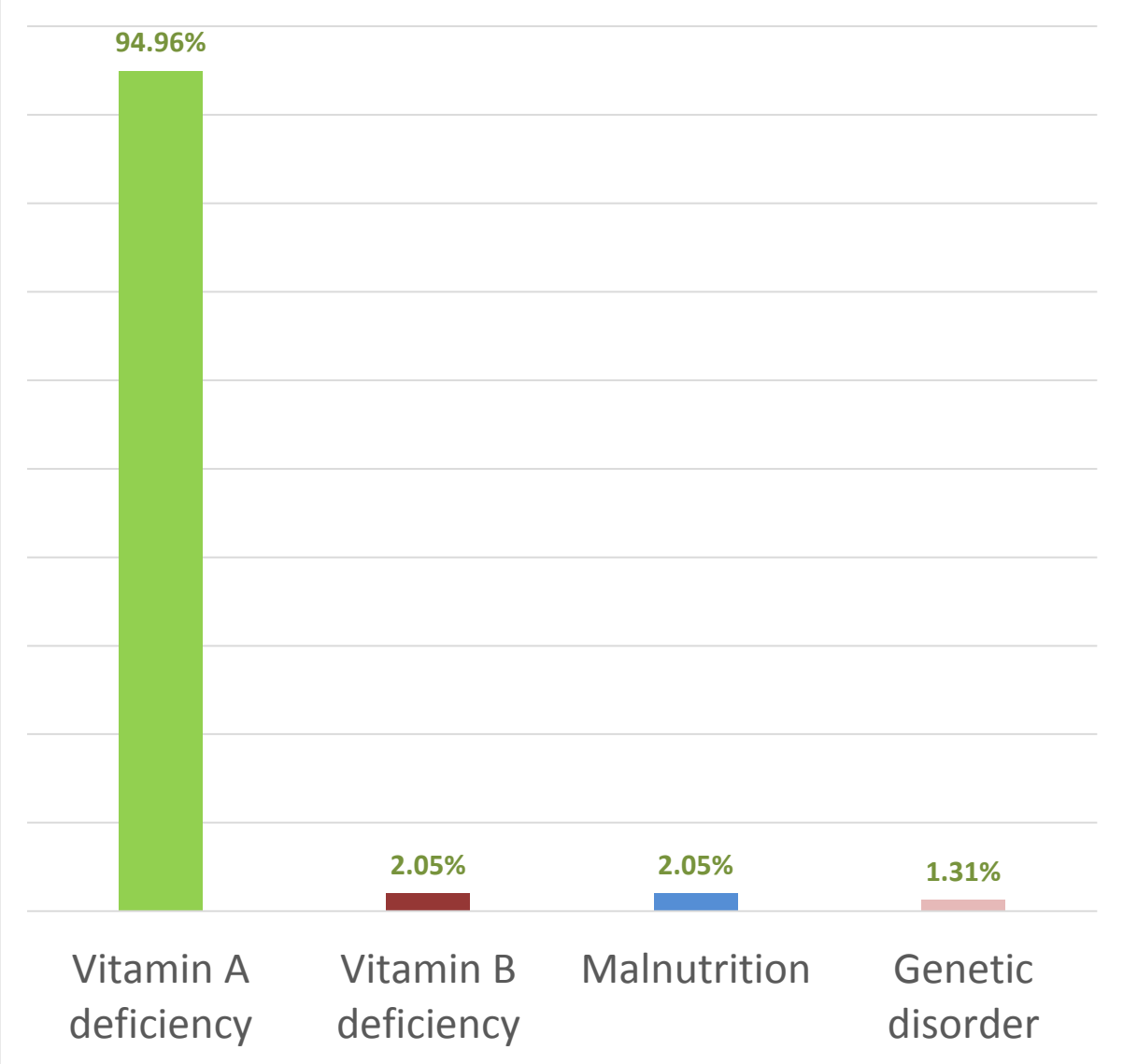

Fig 4.20: Common Cause of Night Blindness

Vitamin A deficiency was marked by 94.96% of the students as the main cause of Night blindness. On the other hand, only 2.05% answered Vitamin B deficiency and 2.05% thought Malnutrition is the main reason behind it. Lastly, 1.31% answered genetic disorder as the root cause.

4.7.4 Possibility of Prevention at Childhood

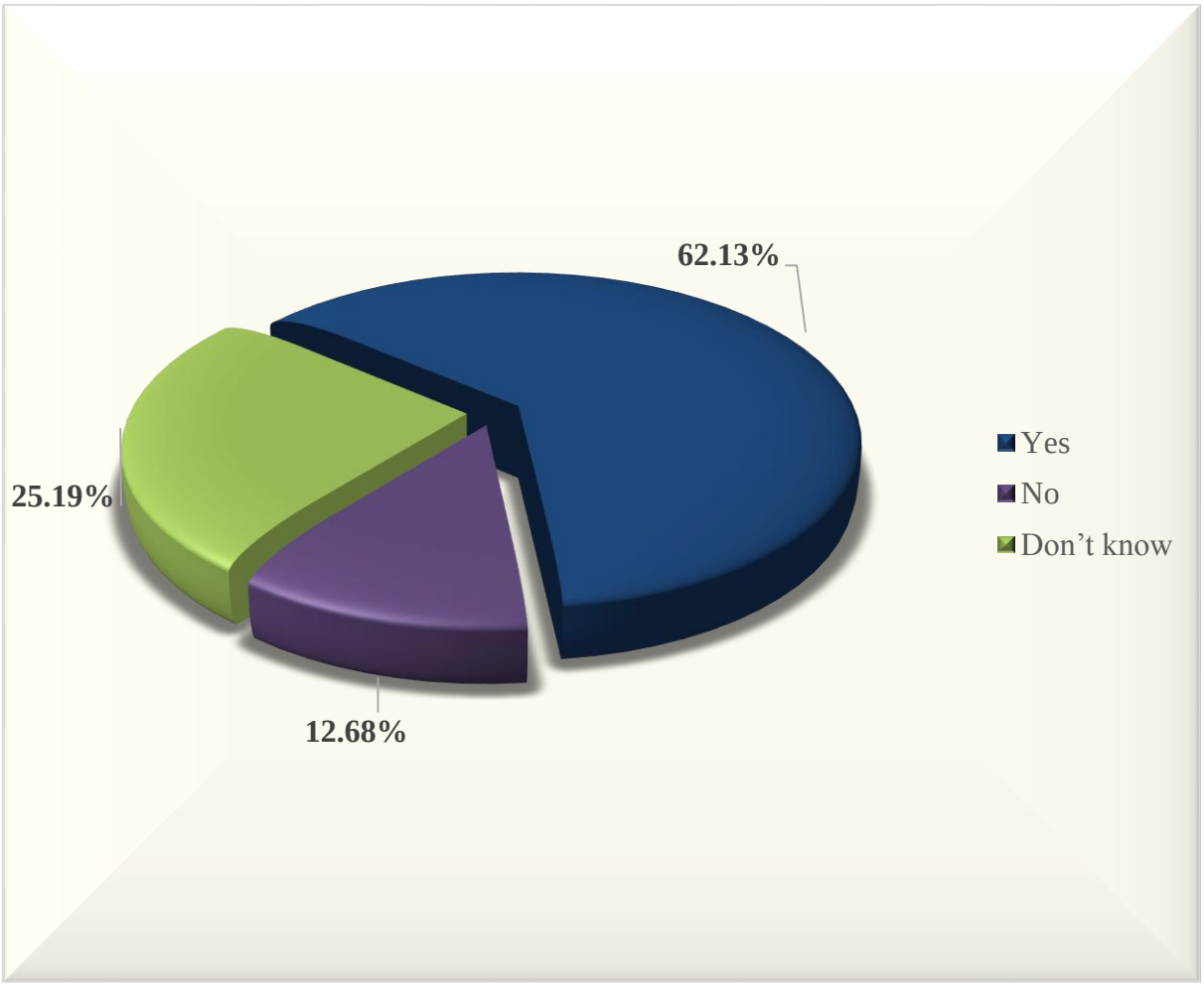

Fig 4.21: Possibility of Prevention at Childhood

It was observed that 62.13% students answered that they think that night blindness can be prevented during childhood and only 12.68% thought otherwise.

4.7.5 Knowledge of Preventive Methods

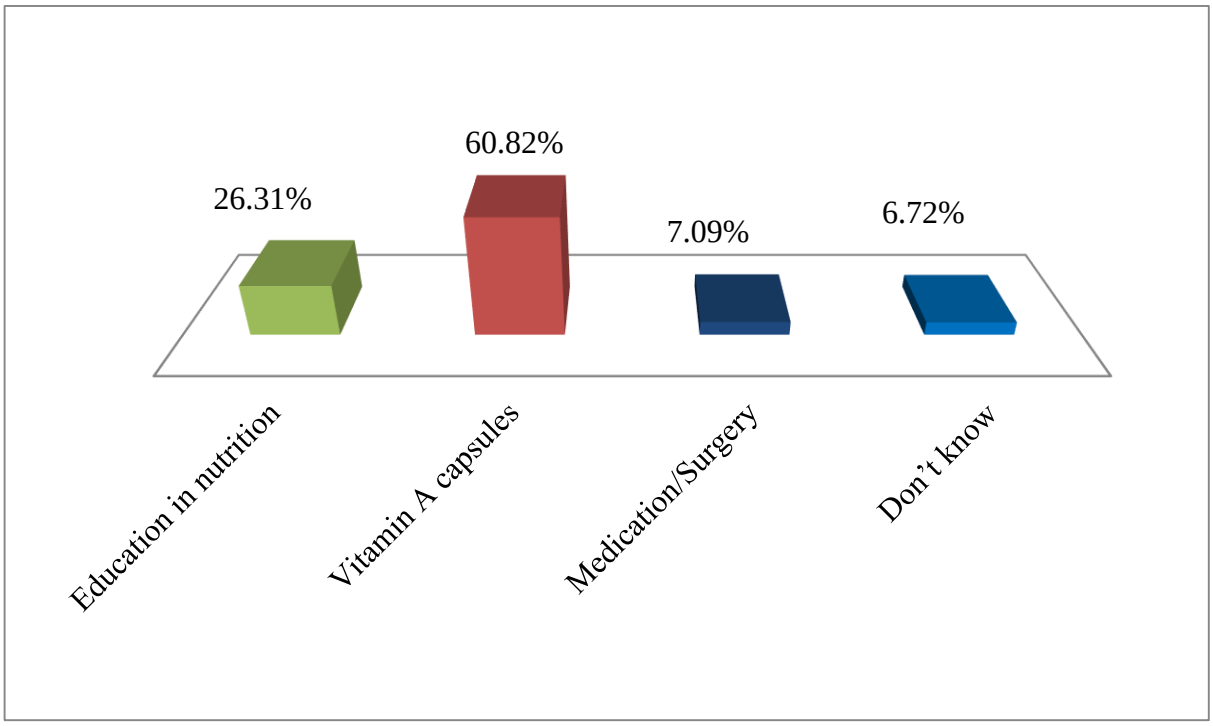

Fig 4.22: Knowledge of Preventive Methods

During this study it was seen that, almost 60.82% students thought Vitamin A capsules as a prominent preventive measure. Education about nutrition as preventive measure was answered by 26.31% of the students who know about night blindness. Only 7.09% thought about medication/surgery.

4.7.6 Possibility of Getting Vision Back from Night Blindness

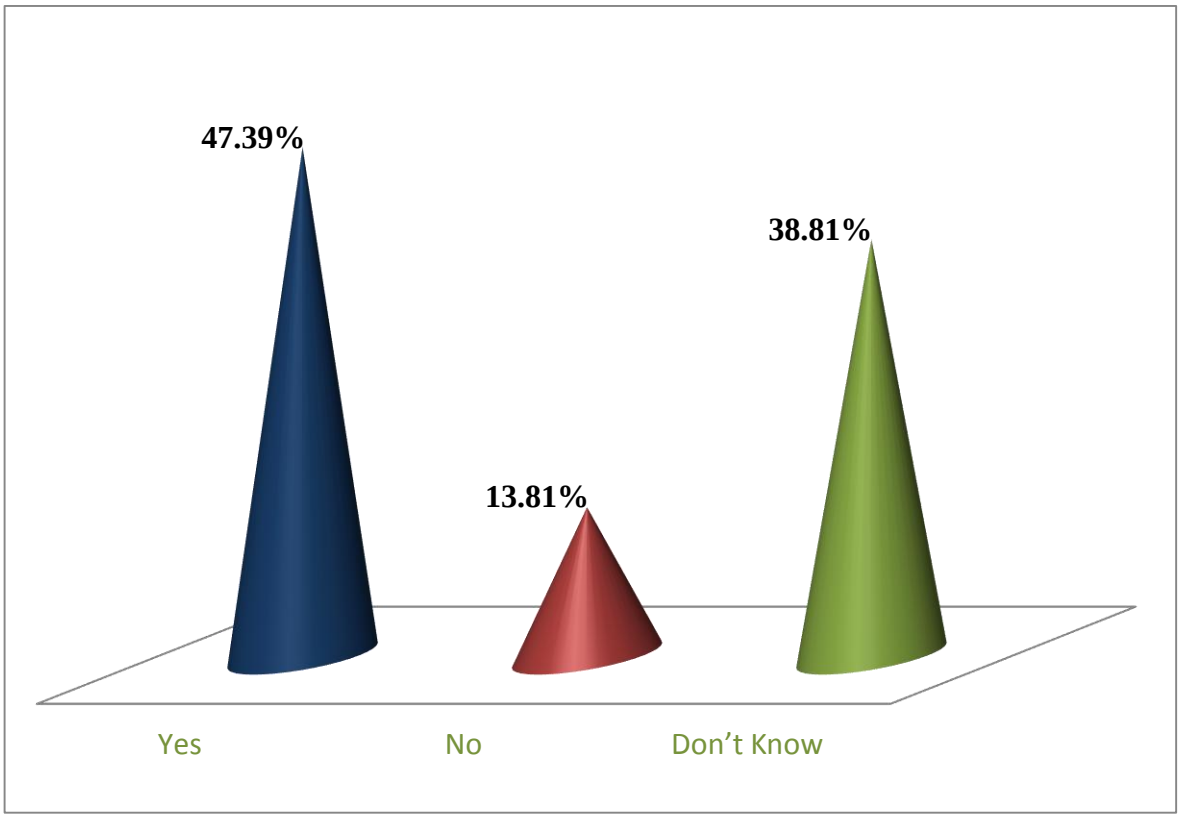

Fig 4.23: Possibility of Getting Vision Back from Night Blindness

From the study, it was seen that 47.39% of the population thinks that it was possible to get vision back from night blindness and 13.81% students thought otherwise.

4.8 Diabetic Retinopathy

4.8.1 Knowledge about Diabetic Retinopathy

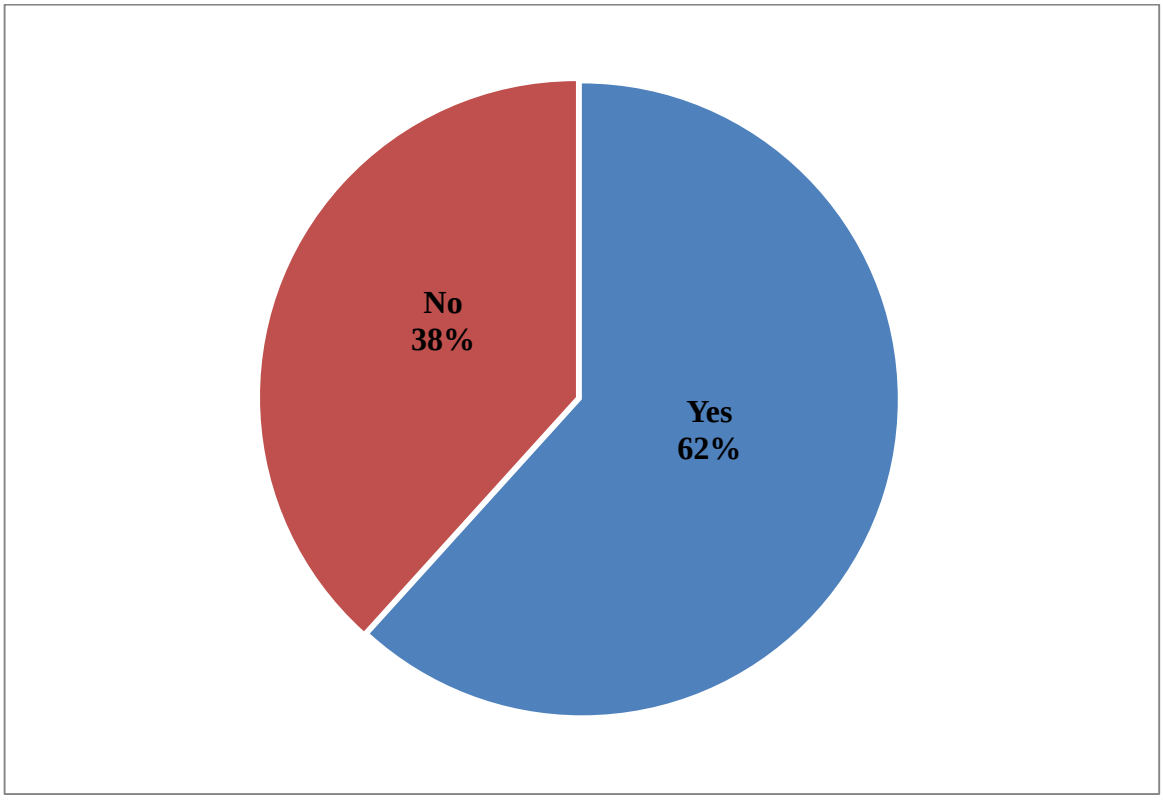

Fig 4.24: Knowledge about Diabetic Retinopathy

Among 572 students, 61.71% of them answered that they have heard about Diabetic Retinopathy and the remaining 38.29% students said that they didn't heard about Diabetic Retinopathy**.**

4.8.2 Source of Knowledge

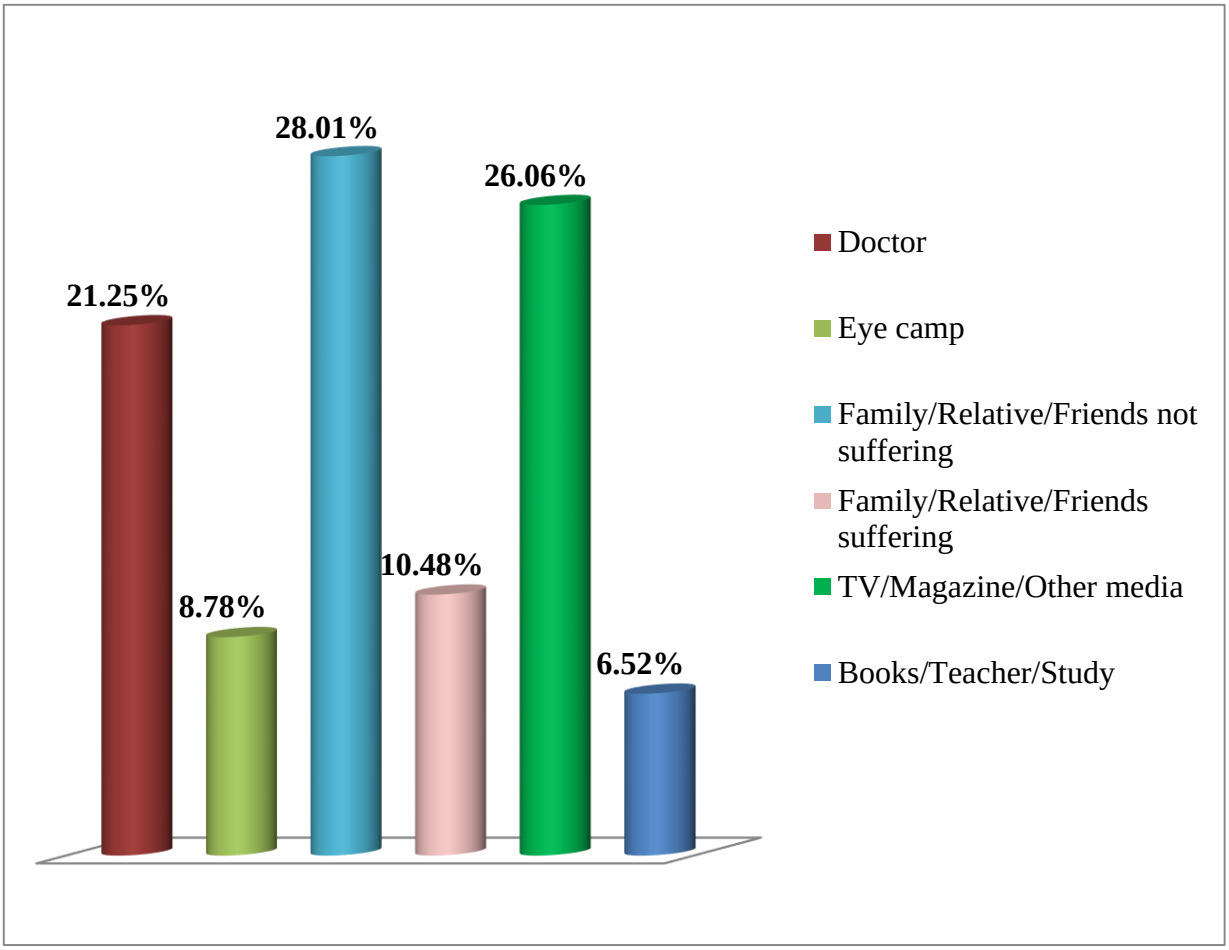

Fig 4.25: Source of Knowledge

Highest number of students (28.01%) knew it about from their unaffected family/relative/friends. 21.25% marked as Doctor. Again, 26.06% of them knew about it from TV/magazine/other media and remaining students learned from Books/Teachers/Study 6.52%.

4.8.3 Knowledge about Treatability Due to Loss of Vision Level

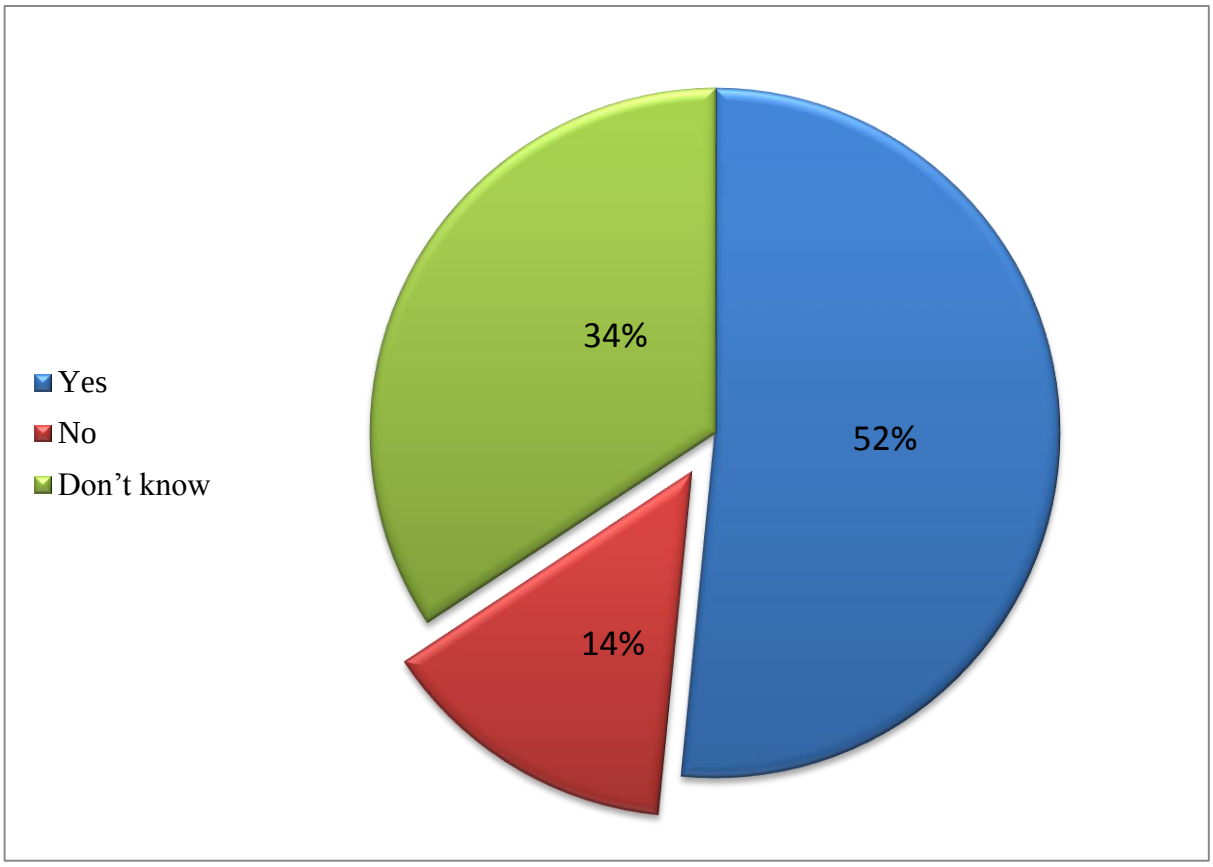

Fig 4.26: Knowledge about Treatability Due to Loss of Vision Level

The selected questionnaire provided question about possibility of treatment due to vision decrease, from that 51.56% of the students who had heard of Diabetic retinopathy answered that they agree that the decrease in vision due to Diabetics is treatable. Other 14.16% answered negatively and the rest of the students 34.28% answered they don't know about it.

4.8.4 Knowledge about Frequency of Eye Checkup

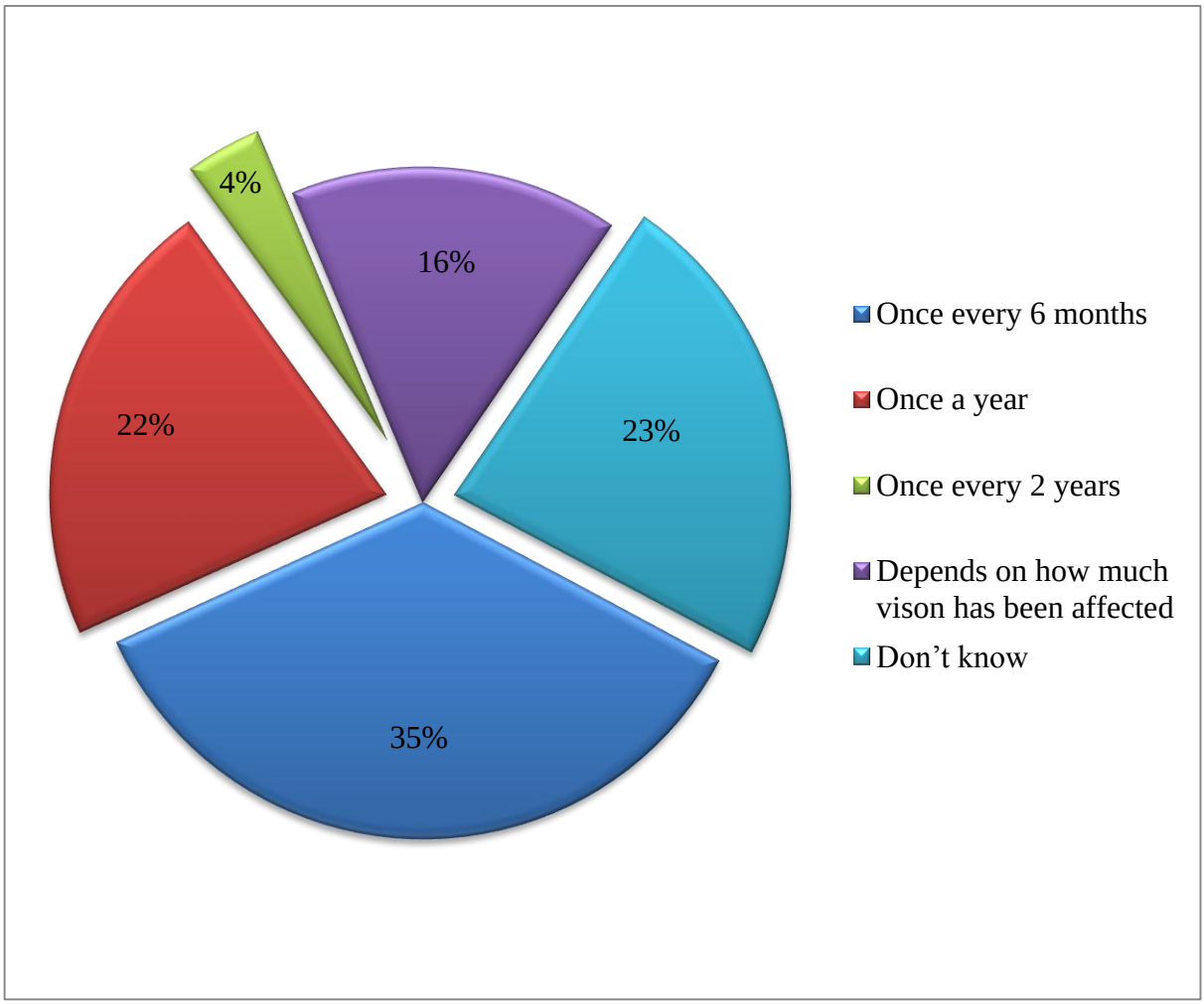

Fig 4.27: Knowledge about Frequency of Eye Checkup

Among the 353 students, 35.41% said that once every 6 months the patient should go for checkup. 15.86% of students thought that it depends on how much vision has been affected it. Lastly, 3.68% thinks that once every 2 years the patient should attend eye checkup.

4.8.5 Knowledge of People Who Are At Risk at Diabetic Retinopathy

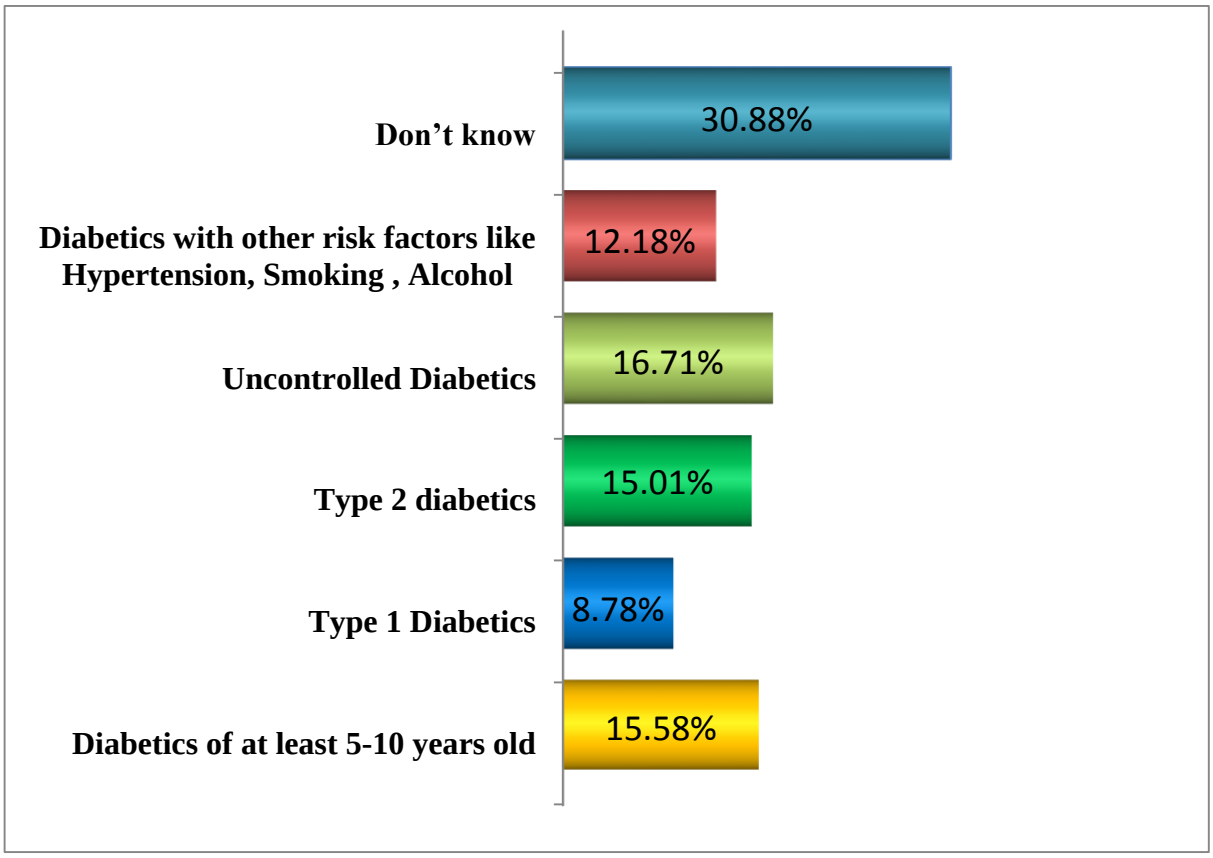

Fig 4.28: Knowledge of People Who Are at Risk for Diabetic Retinopathy

From the answers of the students it was seen that around 30.88% didn't have any knowledge about who are at risk of Diabetic Retinopathy. Only 15.58% answered that those patient who have diabetics for at least 5-10 years were at more risk for Diabetic Retinopathy. Type 2 diabetics were marked by 15.01%.

4.8.6 Knowledge of Diabetic Retinopathy Treatment

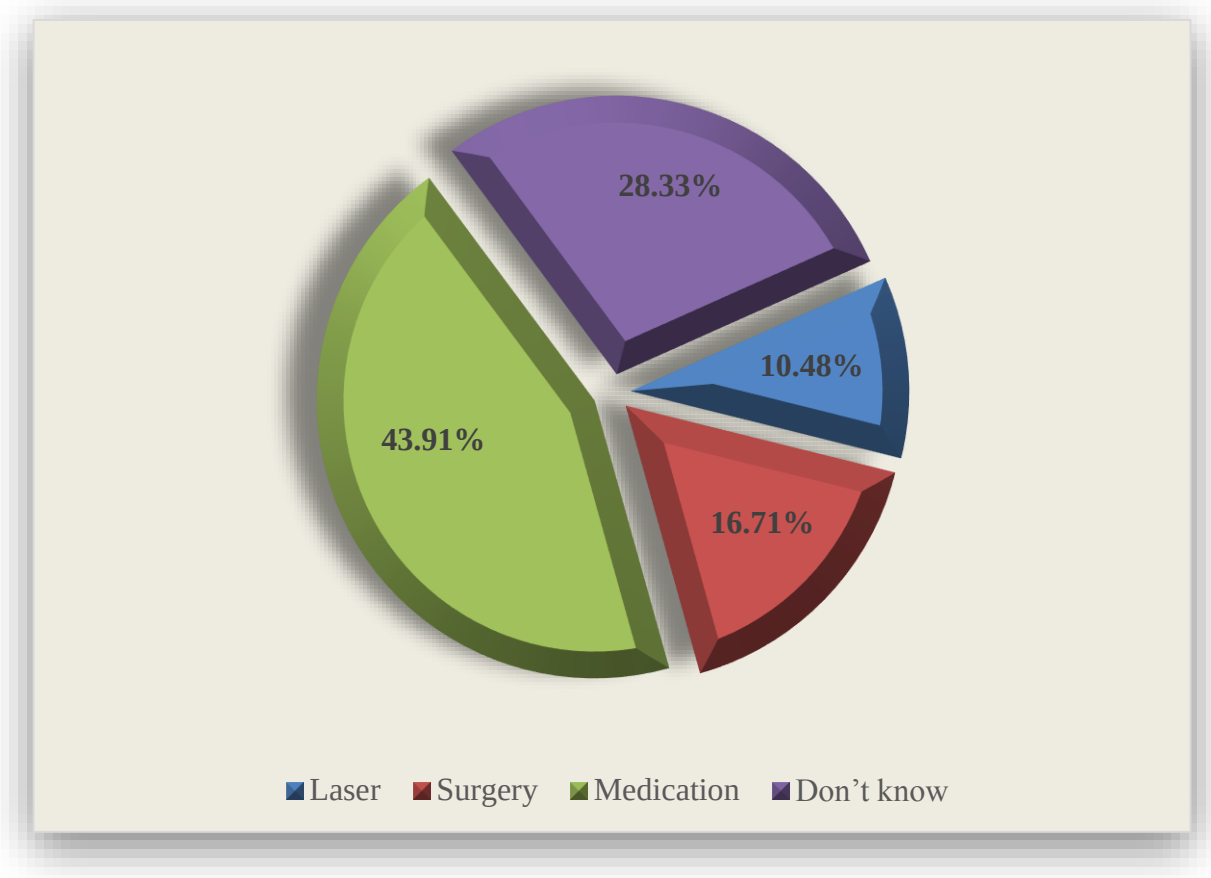

Fig 4.29: Knowledge of Diabetic Retinopathy Treatment

Of the 353 students, majority of the students (43.91%) said that medication was the treatment for the disease and only 10.48% thought that Laser treatment was the treatment for Diabetic Retinopathy.

Chapter 5

Discussion

&

Conclusion

Discussion

In many low & middle-income and industrialized countries, three eye conditions have emerged as potential threats to the status of sight of their populations. They are Diabetic Retinopathy, Glaucoma and Cataract. The increase of diabetes among many population groups has caused diabetic retinopathy to be added to the priority list, while glaucoma, an eye disease known for centuries, remains on the public health agenda due to difficulties in its early diagnosis and frequent necessity of life-long treatment. Another important eye disease is cataract. Due to which, the main objective of this study is to identify the present condition of knowledge and awareness regarding eye diseases (WHO, 2016).

The study was conducted over a population of 572 university going students and they were from different discipline of subjects, the majority was form department of science and engineering 43.16% and department of health sciences 26.57%. Among that 71.85% students were male and rests of them were female.

The sample was aged between 18 to 29 years and most of them (59.27%) belonged to higher middle class family.

Having heard of disease in question was defines as ‘awareness’ and having understanding of the eye disease was defined as ‘knowledge’.

During the study it was observed that 84% of the students responded that they were aware of the disease cataract blindness. The study of Dandona et al., (1993) and study of Chew, Reddy and Karina (2004) also found similar observation but in higher age group. The knowledge of Cataract was found to be 69.8% and 88.2% respectively in case of above of the two studies.

Despite the students were aware about Cataract, only 45.95% of them had correct knowledge that it is a white membrane growing over the eye. And majority didn’t have the exact knowledge about what it is. This was also similar with the study of Dandona et al., (1993) and study of Chew, Reddy and Karina (2004) as they assessed poor and moderate knowledge about Cataract respectively.

The major sources of knowledge were family/friends/relative who were not suffering from the disease (31.81%) and TV/Media/Newspaper (21.62%). Surprising fact was observed that only 6% of them learned about it in studies/books or by teacher.

Students were knowledgeable that surgery was necessary eye treatment for cataract blindness but maximum didn't know about the type of surgery. It was concluded by observing that only 48% of them knew about Intra Ocular Lens Implantation.

While observing Glaucoma, it was found that very moderate percentages (47%) of students were aware about glaucoma. The study of Ronnie et al., (2009) found 13.5% awareness of Glaucoma. Similar study done by Rewri and Kakkar (2014) found about 8.3 % respondents were aware about Glaucoma.

While observing knowledge, about half of sample could correctly know the right definition of Glaucoma and another 20% had decent idea about it. As like cataract their source of knowledge came from Friends family relative not suffering from it and TV media and newspaper.

Although having knowledge about definition, poor percentage knew that Glaucoma blindness is permanent and also poor percentage correctly answered about possibility of getting vision back from blindness. And one third of the sample marked medicine and another third marked surgery as their treatment option. This findings is similar with the study of Rewri and Kakkar, 2014 as they found only 1.89 %, 93 out of 4927 were qualified as having knowledge about Glaucoma

Awareness about Night blindness was spectacular in the present study.88% of the students were aware of the disease and again 95% of correctly knew the right cause of blindness.

The source of knowledge was similar as above two diseases. And the observed study showed that they think of it as a preventive disease in childhood and had nearly correct knowledge of preventive methods.

The awareness of knowledge about Diabetic Retinopathy was good (62%). The study of Mwangi and Gihinjii (2011) found that 83% respondents heard about Diabetic Retinopathy and 60% knew relationship between diabetic eye disease and diabetes. The study of Tajunisah, Wang and Tan (2011), Chew, Reddy and Karina (2004) found in

their study about 86 % and 83.5% respectively as their awareness about Diabetic Retinopathy. In Bangladesh a study done on rural districts found that only 4.1% of people knew about Diabetic Retinopathy (Islam et al., 2015).

Despite the awareness, half of the students (52%) were knowledgeable about decrease in vision was treatable and had poor knowledge about the original risk factors of the diabetic retinopathy. Type-2 diabetics were marked by 15% and uncontrolled diabetes by 18%. This is similar with the study of Wang and Tan (2011) where lack of understanding on Diabetic Retinopathy (68%) were the main barrier for most patients for not coming to eye screening

The study of Tajunisah, Wang and Tan (2011) resulted that 43.8% didn't have learning about how frequent they should go for an eye checkup and 72.3% didn't know about what treatments were available. In the present study it was observed that around 35% didn't know the frequency of eye checkup and only 10.48% knew about right treatment of Diabetic Retinopathy.

Conclusion

Based on all the facts, it can be concluded that knowledge and awareness about Cataract, Glaucoma and Diabetic Retinopathy are not at good state at all. Even in the young generation, the knowledge is lacking and not up to the level as it is supposed to be. However due to the minimal exposure in the education system, they don't get as much information as they were supposed to be. Consequently they will suffer from different complications. At this point, the only way to remedy is to promote health awareness programs and much other awareness related things. It is however need to mention that this research was conducted on randomly chosen universities and in a very small scale so it doesn't reflect the whole idea. Therefore it is suggested that if a conclusive result about the awareness of eye diseases is desired, further large scale researches should be conducted.

Chapter 6

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