*Pakistan J. Zool., vol. 54(3), pp 1209-1214, 2022* **DOI**: https://dx.doi.org/10.17582/journal.pjz/20200921070958

# Etiology and Association of Congenital / Acquired Cataract, with Other Ocular Anomalies in Pakistani Population

**Neelam Saba and Saba Irshad***
*Institute of Biochemistry and Biotechnology, University of the Punjab, Lahore*

## ABSTRACT

The objective of the study was to check the etiology of congenital and acquired cataract and its association with other ocular anomalies in population of Punjab, Pakistan. Frequency of laterality and its association with consanguinity in congenital cataract cases was also studied. This study was conducted on 192 cases of congenital and acquired cataract presented at LRBT Hospital and Mughal Eye Hospital, Lahore (March 2016-September 2019). Children under 15 years of age (mean age=2.2 ± 1.03 years) and diagnosed with congenital or acquired cataract were included in the study. Among 192 cases of cataract 166 were of congenital and 26 were of acquired cataract during childhood. Among 166 congenital cases, 97(58.4%) cases were bilateral and 69 (41.6 %) were unilateral. Maximum number of cases of congenital cataract was observed in idiopathic group (40.96%) with unknown etiology. Among 61 (36.74%) inherited congenital cataract cases, 70.49 % cases were bilateral. In acquired cataract unilateral cataract was the predominating factor (88.5%). A significant correlation was observed between etiology and laterality ($p$=.023) of congenital cataract. Among 97 bilateral cases 67.01 % parents were cousins ($p$=.008). Most commonly observed anomalies associated with congenital cataract were leukocoria and strabismus, later showing 73.33% association with unilateral cataract. Study revealed that consanguineous marriages are a risk factor for bilateral congenital cataract. Late age of presentation of cataract cases to hospital complicates the situation.

**Article Information**
**Received 21 September 2020**
**Revised 05 November 2020**
**Accepted 14 November 2020**
**Available online 09 June 2021 (early access)**
**Published 21 February 2022**

**Authors' Contributions**
**NS designed the study, collected the clinical data, did data analysis and made a final draft of the study. SI supervised the study.**

**Key words**
**Etiology, Idiopathic, Congenital cataract, Acquired.**

## INTRODUCTION

Cataract is an eye disorder which is defined as any opacity or cloudiness of the crystalline lens (Hejtmancik, 2008). Congenital cataract is a lens opacity which is presented at birth or shortly after birth while infantile cataracts develop during 1st year of life. Congenital cataract is the major cause of reversible blindness in children worldwide (Gilbert and Foster, 2001). The prevalence of congenital cataract is 1-6/10,000 live births in developed countries while 5-15/10,000 live births in underdeveloped countries and it varies according to the socioeconomic status of the country (Khan *et al*., 2018). It can be unilateral or bilateral depending on the cause. Prevalence of congenital cataract does not depend on gender or literality (Khokhar *et al*., 2017). On the basis of observational studies carried in different parts of the world it has been found that 60 % cases are idiopathic, 25-30% are genetic, 2-3% cases of congenital cataract are due to intrauterine infections of the mother, and remaining 10% have unknown reasons (Nihalani, 2015).

In developed countries hereditary congenital cataracts occur most frequently. Inherited congenital cataracts occur with all types of Mendellian inheritance patterns in syndromic and non-syndromic forms with more than 100 genes involved (www.cat-map.wustl.edu) (Messina-Baas and Cuevas-Covarrubias, 2017). Congenital cataracts may be inherited as autosomal dominant, autosomal recessive, or X-linked recessive forms but autosomal dominant is the most frequently inherited form of congenital cataract. Congenital cataracts can occur as isolated defects or they may also be associated with other developmental ocular anomalies of the eye such as microphthalamia or aniridia (absence of iris). Association of ocular anomalies with congenital cataract is 27 % while 22 % cases are associated with systemic anomalies called syndromes. Leukocoria and strabismus are the two most common anomalies associated with congenital cataract and association has been found in 24 % and 19 %, respectively (Khokhar *et al*., 2017).

Control of pediatric blindness is the major goal of WHO vision 2020, Right to Sight programme. Earlier management of congenital cataract has a beneficial role to overcome the social, economic and emotional difficulties in the life of individuals. Two main challenges to overcome congenital cataracts are diagnosis and management of congenital cataract. There should be a proper system for public awareness, early detection of cataract and referral to specialized health care facilities. To properly manage cataract there should be proper infrastructure, surgical

* Corresponding author: saba.ibb@pu.edu.pk
0030-9923/2022/0003-1209 $ 9.00/0

equipment and expertise in hospitals. Regular long follow up are very important to prevent complications after surgery such as glaucoma and amblyopia (Dohvoma *et al*., 2020). To prevent childhood blindness routine ocular examination of infants is very important in hospitals so in case of any ocular anomaly such as congenital cataract possible treatment should be provided as soon as possible to prevent further complications in the treatment. This study was carried out to find out the etiology of congenital cataracts and its association (unilateral/bilateral) with consanguinity and different ocular anomalies in population of Punjab province of Pakistan attending LRBT eye hospital, Lahore and Mughal Eye hospital, Lahore.

## PATIENTS AND METHODS

All congenital and acquired cataract cases included in this study were recruited from Layton Rahmatullah Benevolent Trust (LRBT), Lahore, and Mughal Eye hospital, Lahore from March 2016-September 2019. An approval letter was signed from bioethical committee of The University of the Punjab, Lahore to study on human objects. Objective of the study was explained and consent was obtained from the administrative authority of the hospitals. Informed consent was also obtained from the guardian of the affected children and a questionnaire was filled at the hospital. Total 192 affected individuals under 15 years of age with congenital and acquired cataract were included in the study excluding all congenital cataract cases having trauma or injury. Detailed medical history and ophthalmic examination of affected individuals were done at the hospital by expert ophthmologists.

Visual acuity of children above 3 years of age was checked by Snellen chart while children <3 years were checked by light perception or by checking behaviour of following an object. Slit lamp examination was done by ophthmologists at the hospitals to check the anterior segment of the eye. B scan (brightness scan) was also done where required. Ophthalmic examination was done in detail while medical history of infection of the foetus at the time of delivery or of the mother during pregnancy was recorded from the previous medical reports. Detailed family history and consanguinity of the parents was also taken for familial cases of congenital cataract. Patients having family history of congenital cataract were further contacted for genetic studies later on.

All cases of congenital / acquired cataract were divided into different groups according to age of diagnosis at the hospital. Cases of congenital cataract were also classified on the basis of laterality of cataract into unilateral and bilateral groups. Association of laterality with consanguinity was also observed. Different ocular anomalies associated with cataract were also examined. IBM SPSS (Statistical Package for Social Sciences Version: 20) software was used for statistical evaluations.

## RESULTS

During the study 192 children less than 15 years of age (mean age = 2.2±1.03 years) with congenital or acquired cataract were examined. Among 192 cases 166 were of congenital cataract and 26 were of acquired cataract. Among 166 congenital cataract cases, 81 (48.8%) were males and 85 (51.2%) were females. In case of acquired cataract 16 were males and 10 were females.

All congenital cataract cases were distributed into 4 age groups as, group 1 (0-6 months), group 2 (7-12 months), group 3 (2-7 year), and group 4 (8-13 year). The maximum numbers of cases 52 (31.3%) were observed in 0.7-1 year age group; while least no of cases, 24 (14.5 %) were observed in 8-13 year age group.

Cases of congenital cataract were also categorized depending upon the etiology factors into 1) Idiopathic 2) Inherited 3) Intrauterine infections and 4) Birth complications group. Maximum number of cases was observed in idiopathic group. Inherited congenital cataract group consists of individuals with family history of congenital cataract and children of cousin parents. In intrauterine infections group, cases with maternal infection during pregnancy were included. Cases with postnatal bleeding, low birth weight and postnatal hypoxia were included in birth complications groups (Table I). Among 166 cases of congenital cataract, 97 (58.4%) cases were bilateral and 69 (41.6 %) cases were unilateral. It was observed that 88.5% of acquired cataracts were unilateral. Maximum number of bilateral cases was observed in inherited case group (Table II). Association of laterality with etiological factors was found significant at $p$= 0.023.

**Table I.- Age wise etiological classification of congenital cataract cases.**

| Age groups (year) | Factors | | | | Total |
|---|---|---|---|---|---|
| | Idiopathic | Inherited | Intrauterine infections | Birth complic. | |
| 0-0.6 | 21 | 15 | 9 | 6 | 51 |
| 0.7-1 | 23 | 18 | 8 | 3 | 52 |
| 2-7 | 12 | 20 | 4 | 3 | 39 |
| 8-13 | 12 | 8 | 1 | 3 | 24 |
| Total | 68 | 61 | 22 | 15 | 166 |

Consanguinity of the parents was also noticed among each age group and it was observed that in 97 cases of bilateral congenital cataract 65 were cousins and 32 were not cousins. In 69 unilateral congenital cases 32 parents were cousins while 37 were not cousins. From the Pearson correlation $p$= 0.008 was observed which is significant for correlation. So there is strong association between consanguinity and bilateral congenital cataract (Fig. 1).

**Table II.- Frequency of laterality within each etiological group.**

| | Etiology | Laterality | | |
|---|---|---|---|---|
| | | Unilateral | Bilateral | Total |
| Primary congenital (n=166) | Idiopathic | 27 | 41 | 68 |
| | Inherited | 18 | 43 | 61 |
| | Intrauterine infections | 14 | 8 | 22 |
| | Birth complication | 10 | 5 | 15 |
| Acquired (n=26) | Inflammation | 10 | 0 | 10 |
| | Idiopathic | 13 | 3 | 16 |

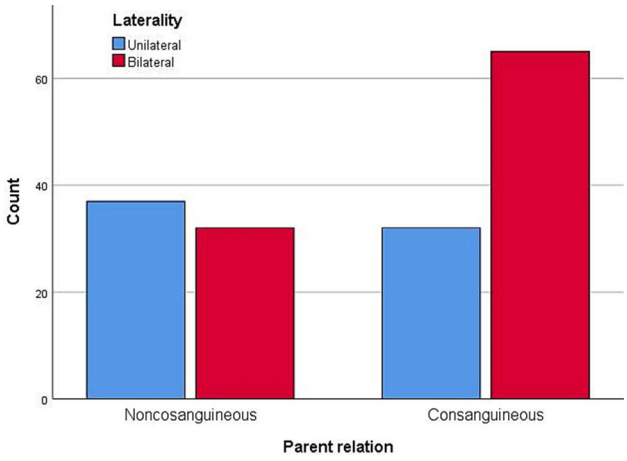


Fig. 1. Association between consanguinity and laterality of congenital cataract.

Among 166 cases of congenital cataract the most commonly observed complication with congenital cataract was extreme myopia. Other associated anomalies with cataract were leukocoria, strabismus (squint), nystagmus, microphthalmia, photophobia, post-surgical glaucoma and retinal dystrophy. Retinoblastoma, night blindness and keratoconus were seen in very small number of cases of congenital cataract (Table III).

A significant correlation was observed between laterality and eye anomalies as $p$= 0.044 was observed. It was observed that all nystagmus (jerky eye movement) cases were unilateral (congenital cataract) (Fig. 2).

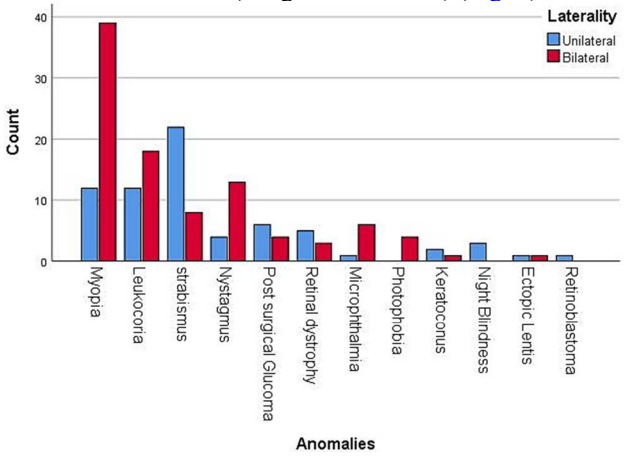


Fig. 2. Association of laterality and eye anomalies.

**Table III.- Frequency of ocular anomalies associated with congenital cataract.**

| Ocular anomalies | Frequency (%) |
|---|---|
| Myopia | 51 (30.7) |
| Leukocoria | 30 (18.1) |
| Microphthalmia | 7 (4.2) |
| Strabismus (misaligned eyes) | 30 (18.1) |
| Nystagmus | 17 (10.2) |
| Photophobia | 4 (2.4) |
| Keratoconus | 3 (1.8) |
| Ectopic Lentis | 2 (1.2) |
| Post-surgical Glucoma | 10 (6.0) |
| Retinal dystrophy | 8 (4.8) |
| Retinoblastoma | 1 (0.6) |
| Night blindness | 3 (1.8) |
| Total | 166 (100) |

## DISCUSSION

This study was carried out at Layton Rahmatullah Benevolent Trust (LRBT), Lahore and Mughal Eye hospital, Lahore. These two hospitals have referral base and children with congenital or infantile cataract are referred from throughout the Punjab in the hospital.

This study was carried out on 192 cases of childhood cataract in which 166 (81 males, 85 females) were of congenital cataract and 26 (16 males and 10 females) were acquired during childhood. Similar study was carried out in Indian population and male to female ratio was 1:1.2 (Pandey *et al*., 2016). A study was carried on childhood cataract in Cameroon recently and 62.5 % cases were

found congenital (Dohvoma *et al*., 2020).

Among 166 cases of primary congenital cataract 69 (41.6%) were unilateral while 97 (58.4 %) were bilateral. It was observed that 88.5% acquired cases were unilateral. This was also the case in a recent study (Dohvoma *et al*., 2020).

A study carried on etiology and prevalence of congenital cataract in UK, 66% cases of congenital cataract were found to have bilateral disease (Rahi *et al*., 2000). In this study most of the cases (31.23%) were presented in hospital in age 0.7-1 year. Least number of cases were presented in group 4 (8-13 year). It was found by clinical studies that optimum age for surgery for unilateral congenital cataract is < 6 weeks while for bilateral congenital cataract <10 weeks (Rajavi and Sabbaghi, 2016). So very early diagnosis of congenital cataract is required for proper surgical treatment.

Cases of congenital cataract were divided into 4 different groups according to etiology observed. Maximum numbers of cases were associated with unknown etiology (idiopathic) and it was found that most of the cases in this group were bilateral (60.29 %). In a similar study on Danish population almost two third cases were found idiopathic and among idiopathic cases 50% cases were bilateral (Haargaard *et al*., 2004). Total 61 cases were identified with a family history of congenital cataract and it was found that 43 cases (70.49%) were bilateral. In a study in China among 11% inherited congenital cataract cases 56% cases were bilateral (Zhu *et al*., 2017). In another study done on clinical characteristics of congenital cataract, 22.4% cases of congenital cataract were familial and among them 98 % were bilateral (Nagamoto, 2015).

Association of consanguinity and laterality of congenital cataract was also observed. It was found that 67.01 % parents of 97 bilateral congenital cataract cases were cousins and 32.98 % were not cousins. A similar study was done at Rawalpindi Holy Family Hospital and consanguinity was observed in 69.6 % of bilateral cases (Rana *et al*., 2014). So it was found that incidence of bilateral congenital cataract is more as compared to unilateral but it does not have an association with gender or age.

Various eye anomalies were also observed with congenital cataract in this study. Extreme myopia which is a complication of congenital cataract was observed in 30.7% of cases. The two most commonly observed anomalies seen were leukocoria and strabismus (squint), both with 18.1 % prevalence. Leukocoria means white pupil reflex and it is an alarming condition for various eye anomalies diagnosis. In another study in 2018 it was found that congenital cataract shows 60 % association with leukocoria (Dargahi *et al*., 2018). Strabismus was the second most commonly associated anomaly in this study and it was observed in 18.1 % cases similar to Zhu *et al*. (2017) report which was 20.6 %. It was also observed in this present study that 77.33 % strabismus cases were diagnosed with unilateral congenital cataract. Association of strabismus was 18.1% with congenital cataract as observed by Kim *et al*. (2012). Association of strabismus only with unilateral cataract was observed in this study.

4.2 % of cases of congenital cataract have microphthalmia in which eye size is very small. Dhovoma *et al*. (2020) observed microphthalmia in 1.8 % of 56 congenital cataract cases. Zhu *et al*. (2017) found the association with microphthalmia in 1.9 % of congenital cataract cases. Haargaard *et al*. (2004) found that microphthalmia is the most commonly observed anomaly in hereditary congenital cataract. Kumar *et al*. (2019) studied that among congenital eye anomalies microcornea/ microphthalmia was the most commonly observed eye anomaly.

Nystagmus (jerky eye) was observed in 10.2 % of cases in this study. Strabismus and nystagmus are the complications of congenital cataract and surgery is recommended either in case of unilateral or bilateral before the appearance of these two conditions (Rajavi *et al*., 2015). Zhu *et al*. (2017) observed nystagmus in 11.9 % of patients. In other studies it was found that nystagmus is more commonly associated with bilateral than unilateral cataract (Kim *et al*., 2012).

In this study post-surgical glaucoma was observed in 6 % of cases. A study carried out to access the risk factors for the development of glaucoma after congenital cataract surgery. After post-operative follow-up of 5 years glaucoma was observed in 20 % of bilateral cataract cases and in 12 % unilateral cataract cases. It was observed that careful follow-up after cataract surgery is very important to decrease the incidence of glaucoma in aphakic eyes (Solebo and Rahi, 2020).

Those studies were done on large sample size and follow-up period was also recorded therefore incidence of post-surgical glaucoma was greater as compared to our study. In a study to find out the surgical outcome of congenital cataract different post-surgical complication were observed in which secondary glaucoma was observed in 12 % of cases (Uzun and Atilla, 2020). It was observed that risk of glaucoma after cataract surgery was high for those individuals in which age of surgery was <9 months (Haargaard *et al*., 2008). Retinal dystrophy was observed in 4.8% cases in our study, mostly in cases which were diagnosed in late age or in which surgery was delayed. Glaucoma is a post-surgical complication observed in various congenital cataract case studies. So proper management of cataract is very important after cataract

surgery by implanting IOL (intraocular lens) or aphakic glasses to prevent from further complications (Zhang *et al*., 2019). Other complications such as photophobia, retinoblastoma, ectopic lentis and night blindness were observed in very small no. of cases which may be due to syndromic association with congenital cataract. Retinal dystrophy and iris coboloma association with congenital cataract has been found in syndromes recently (Messina-Baas and Cuevas-Covarrubias, 2017).

## CONCLUSION

It was concluded from the study that consanguinity is an important risk factor for bilateral congenital cataract. Due to high proportion of idiopathic cases congenital cataract is a big challenge to overcome therefore there should be proper research on etiology factors causing congenital cataract. Counseling of parents about treatment options, timing of surgery and routine follow up is very important to avoid further complications. There should be no gender discrimination and equal medical care should be provided to both male and female patients.

## ACKNOWLEDGEMENTS

We are thankful to the families for participating in the study and pediatric ophthmologists at LRBT Hospital, Lahore and Mughal Eye Hospital, Lahore for their cooperation in clinical evaluation of patients.

*Statement of conflict of interest*

The authors have declared no conflict of interests.

## REFERENCES

Dargahi, R., Haleem, A. and Fahim, M.F., 2018. Frequency of common factors leading to leukocoria in pediatric age group at tertiary care eye hospital: An observational study. *Biostat. Biomet. Open Access J.*., **4**: 47-50.

Dohvoma, V.A., Mvogo, S.R.E., Mvilongo, C.T., Nguena, M.B. and Aboubakar, H., 2020. Epidemiological and clinical profiles of childhood cataract seen at the yaounde central hospital. *J. Ophthalmic. clin. Res.,* **7**: 066.

Gilbert, C. and Foster, A., 2001. Childhood blindness in the context of VISION 2020: The right to sight. *Bull. World Hlth. Organ.*, **79**: 227-232.

Grzybowski, A. and Kanclerz, P., 2019. Early postoperative intraocular pressure elevation following cataract surgery. *Curr. Opin. Ophthalmol*., **30**: 56-62. https://doi.org/10.1097/ICU.0000000000000545

Haargaard, B., Ritz, C., Oudin, A., Wohlfahrt, J., Thygesen, J., Olsen, T. and Melbye, M., 2008. Risk of glaucoma after pediatric cataract surgery. *Invest. Ophthalmol. Vis. Sci*., **49**: 1791-1796. https://doi.org/10.1167/iovs.07-1156

Haargaard, B., Wohlfahrt, J., Fledelius, H. C., Rosenberg, T. and Melbye, M., 2004. A nationwide Danish study of 1027 cases of congenital/infantile cataracts: etiological and clinical classifications. *Ophthalmology*, **111**: 2292-2298. https://doi.org/10.1016/j.ophtha.2004.06.024

Hejtmancik, J.F., 2008. Congenital cataracts and their molecular genetics. *Semin. Cell. Dev. Biol*., **19**: 134-149. https://doi.org/10.1016/j.semcdb.2007.10.003

Khan, L., Shaheen, N., Hanif, Q., Fahad, S. and Usman, M., 2018. Genetics of congenital cataract, its diagnosis and therapeutics. *Egypt. J. Basic appl. Sci.,* **5**: 252-257.https://doi.org/10.1016/j.ejbas.2018.07.001

Khokhar, S.K., Pillay, G., Dhull, C., Agarwal, E., Mahabir, M. and Aggarwal, P., 2017. Pediatric cataract. *Indian J. Ophthalmol*., **65**: 1340. https://doi.org/10.4103/ijo.IJO_1023_17

Kim, I.G., Park, J.M. and Lee, S.J., 2012. Factors associated with the direction of ocular deviation in sensory horizontal strabismus and unilateral organic ocular problems. *Korean J. Ophthalmol.,* **26**: 199-202. https://doi.org/10.3341/kjo.2012.26.3.199

Kumar, A., Shukla, A. and Matoli, D., 2019. Study of congenital ocular anomalies prevalent in routine eye OPD in a tertiary care hospital. *Int. J. Ophthalmol.,* **11**: 1-7. https://doi.org/10.9734/or/2019/v11i230122

Messina-Baas, O. and Cuevas-Covarrubias, S.A., 2017. Inherited congenital cataract: A guide to suspect the genetic etiology in the cataract genesis. *Mol. Syndromol*., **8**: 58-78. https://doi.org/10.1159/000455752

Nagamoto, T., Oshika, T., Fujikado, T., Ishibashi, T., Sato, M., Kondo, M. and Azuma, N., 2015. Clinical characteristics of congenital and developmental cataract undergoing surgical treatment. *Jpn. J. Ophthalmol.,* **59**: 148-156. https://doi.org/10.1007/s10384-015-0370-8

Nihalani, B.R., 2014. Pediatric genetic disorders of lens. *J. Pediatr. Genet*., **3**: 219-227. https://doi.org/10.3233/PGE-14104

Pandey, A.N., Singh, P., Raina, A. V., Kaul, A. and Kakde, A., 2016. Evaluation of effectivity of laser photocoagulation in diabetic retinopathy. *Ophthalmic Res*., **5**: 1-9. https://doi.org/10.9734/

OR/2016/21875

Rahi, J.S. and Dezateux, C., 2000. Congenital and infantile cataract in the United Kingdom: Underlying or associated factors. *Invest. Ophthalmol. Vis. Sci*., **41**: 2108-2114.

Rajavi, Z., Mokhtari, S., Sabbaghi, H. and Yaseri, M., 2015. Long-term visual outcome of congenital cataract at a Tertiary Referral Center from 2004 to 2014. *J. Curr. Ophthalmol.*, **27**: 103-109. https://doi.org/10.1016/j.joco.2015.11.001

Rajavi, Z. and Sabbaghi, H., 2016. Congenital cataract screening (perspective). *J. Ophthalmic Vis. Res*., **11**: 310. https://doi.org/10.4103/2008-322X.188389

Rana, A.M., Raza, A. and Akhter, W., 2014. Congenital cataracts: Its laterality and association with consanguinity. *Pak. J. Ophthalmol*., **30**: 187-192.

Solebo, A.L. and Rahi, J.S., 2020. Glaucoma following cataract surgery in the first 2 years of life: frequency, risk factors and outcomes from IoL under 2. *Br. J. Ophthalmol*., **104**: 967-973. https://doi.org/10.1136/bjophthalmol-2019-314804

Uzun, A. and Atilla, H., 2020. Surgical outcomes of nontraumatic pediatric cataracts. *Open J. Ophthalmol.,* **10**: 115. https://doi.org/10.4236/ojoph.2020.102013

Zhang, S., Wang, J., Li, Y., Liu, Y., He, L. and Xia, X., 2019. The role of primary intraocular lens implantation in the risk of secondary glaucoma following congenital cataract surgery: A systematic review and meta-analysis. *PLoS One,* **14**: e021. https://doi.org/10.1371/journal.pone.0214684

Zhu, X., Du, Y., He, W., Sun, T., Zhang, Y., Chang, R. and Lu, Y., 2017. Clinical features of congenital and developmental cataract in east China: A five-year retrospective review. *Scient. Rep.*, **7**: 1-5. https://doi.org/10.1038/s41598-017-04332-1