

Prevalence of Night Blindness due to vitamin A deficiency in Pakistan: An overview

Shahzara Irshad

Department: School of Health and Life sciences

Institute: University of Management and Technology, Lahore

Shahzarairshad81@gmail.com, s2019232003@umt.edu.pk

Abstract: As we know that night blindness and color vision impairment is the major issue in Pakistan, especially in rural and urban cities of Punjab and Sindh and some cities of the KPK and Baluchistan. These cities are facing the malnutrition, like vitamin A, B, C, D, E, K, deficiencies, and much other food, who cannot afford the rich nutrition food and diet. In this literature review we discuss about the different surveys, demographic socio-economic survey, data analyses by using different tools and technique like chi square test SPSS, ELIZA test sampling and studies related to the night blindness due to the vitamin A deficiency in children between the ages of 1 month to 50 years people, pregnant women and lactating women who are suffering from the night blindness and other disease that is transferred to their children. We discuss about all the WHO reports and international nutrition supplementation programs from 1980 to 2019 and developmental education programs and health programs. Furthermore, training of nurses and health workers for delivering of child, training of the school teachers for educations, awareness and other programs.

Keywords: Night blindness, vitamin A deficiency, WHO, Retinal pigments.

I. INTRODUCTION

In the introduction section of this literature review, the most important points and overview of Pakistan's health conditions mainly night blindness due to the deficiency of vitamin A is given in detail. As we know that deficiency of vitamin A is the most recognizable and worldwide health problem. It can badly affect the pregnant women, young children, old people that increase the risk factors of life like damage and weaken our immune defense systems and decrease the growth etc [Keith P. et al 2002]. It may lead to the effect on the newborn babies mainly from the first 5 month to 8 month of the life [Sommer, et al 2002]. This is all because of the poor dietary foods, malnutrition and poverty in many countries of world. Especially when we talking about the south Asian countries, night blindness have been identified as a critical driver of demographic health and socio - economic position in lower-income South Asian nations and it persists in impoverished contexts where economic hardship exists. Pakistan is included in those countries where Night blindness cases, color blindness, xerophthalmia and all other diseases caused by the deficiency of the vitamin A, have been found. According to the study nearly 15% to 20% women during the 3rd month of their pregnancy were observed to be night blind and low vision, in many countries of south Asia (in 1980 – 1987). And approximately 35% young children ceased with the loss factors of visuals (night blindness), more than the 80% are suffered because of the vitamin A deficiency.

In Pakistan, Approximately 6 million children less than 5 year's age are observed as night blind [WHO 2009]. Between or less than 6 years age of children are assessed by the risking of the night blindness and color blindness in the North West Frontier Province of Pakistan (NWFP), in Karachi most of the primary school students and children nearly 20% are suffering from this diseases. Many cases have been reporting that level of vitamin A is decreased in the breast milk of the mother with high impact of blindness and deficiency of vitamin A [Ahmed, et al 2012]. In this way those mothers who have low vitamin A levels will transfer their disease to the infants through pregnancy or breastfeeding. Therefor many supplementation programs and other health programs are establishing to overcome these risks of night blindness, color blindness, xerophthalmia and Vitamin A deficiency (VAD) but they may take some time to cover up the whole increasing population of Pakistan [West, Jr. (2003)]

As we know that the population is increasing day by day in Pakistan. On the bases of the national survey night blindness and visual impairment is limited in Pakistan then the other countries. Many children of Pakistan are facing much hazardous disease like increasing annually rates of the child mortality and the reason behind is the most death leading infections diarrhea and pneumonia. Pakistan is declaring as the severe subclinical vitamin A deficiency because in Pakistan it is considered as the spreading disease.

Until 1986 there was no evidence or data on the VAD and night blindness in Pakistan. But Pakistan Governmental institute were panning for the overcome the night blindness eye camping. But in 1987, WHO and Pakistani Government took a first survey that was happened in (1988 to 1990), but the result of that survey was that 70 to 75% night blindness was related to the age cataract. At that time in Pakistan National Committee for Prevention of blindness was established in the 1990. NCPB had made a plane (1994 to 1999) for development of the eye care conditions in the Pakistan [Bourne, et al 2005].

According to the National Nutrition Survey 2011, 60% of Pakistani women who are pregnant were hypertensive. Decreased iron levels affect 37 percent of women, 46.7 percent suffer vitamin A insufficiency, 71 percent suffer vitamin D insufficiency, and up to 44.5 percent had low zinc concentrations. These elevated concentrations of nutritional deficiency have a long-term influence on the health of women's children, starting from the moment they are pregnant, resulting in preterm and underweight kids, as well as a vicious cycle of wasting and deformation.

Then they targeted the between 5 to 6 year age of children for giving them vitamin A supplementation via national annual committee, it has reduced the level of mortality related to the diarrhea night blindness xerophthalmia and other diseases. These vitamin A supplementation programs were going on from 1990 to 2013 that gave positive results which was observed and analyzed. But later on in 2014 according to the report of [Fisker et al 2014] vitamin A supplementation has no effect on the mortality and decrease the mortality in all girls and high level of mortality in boys. According to the report of [Mason et al 2015] they said revealed that vitamin A supplementation didn't impact on the vitamin A deficiency. Again it was a big issue of the night blindness, and many other diseases were revealed out in many young children and especially in girls. [Bhutta et al 2015]. Many debates and data were collected on the bases of previous studies and reconsidered the solution of the deficiency of the vitamin A. The human development index (HDI) is a measure of people's health, literacy, and wealth. The HDI scale runs from 0 to 1, with a greater amount signifying more demographic progress. The Human Development Report 2018, released by the United Nations Training Scheme (UNDP), provided us with HDI statistics for 1990, 1995, 2000, 2005, 2010, 2015, and 2017. (26). Lower (HDI 0.550 - 0.699), strong (0.700 - 0.799), and very strong (HDI 0.800) demographic categories were identified.

1) According to the National Nutritional survey 2018 of Pakistan:

Vitamin A Deficiency Among Children Under Five:

About 51.5% of children have vitamin A deficiency, of whom 12.1% have a severe deficiency. Prevalence is slightly higher (51.7%) among boys than in girls (51.3%).

Severe

• 21.1%

Moderate

• 39.4%

Vitamin A Deficiency in Women Age 15-49 Years: Over a quarter of WRA (27.3%) are deficient in vitamin A, with 22.4% experiencing moderate and 4.9% severe deficiency. This is more prevalent among WRA in rural settings (29.3%). Baluchistan (34.6%) has the highest proportion of WRA with vitamin A deficiency.

Severe
4.9%

Moderate
22.4%

Non deficient
72.6%

2) Objectives:

To examine the total population of Pakistan who don't have enough food, money and face the problems of vitamin A deficiency which is the main cause of the night blindness and all other disease which are relate to it. To examine the primary care, treatment, supplementation VA program, data analysis and International Nutritional surveys in Pakistan. To examine the costs of vitamin A deficiencies mainly in the 5 to 6 years of children or less than 5 year.

To determine the major factors that influence the night blindness, color blindness, xerophthalmia and all other severe diseases. We also examine that how vitamin A deficiency is the major cause of night blindness especially in the newborn babies, which is transferred from the mother into the infants, and how it may affect the pregnant women and lactating women. To determine the visual impairment, color blindness and night blindness that is directly related to the socio economic and demographic risk factors and malnutrition in young children, 25 to 30 aged adults people, old people and pregnant women.

3) Prevalence of vitamin A deficiency In Pakistan:

According to the national Nutritional survey of 2001 to 2012, we observe the prevalence of night blindness in lactating women and pregnant women are describing here. These studies were based on the urban and rural areas and those cities of Pakistan where many of poor peoples were living in the poverty and malnutrition areas. Their chances of night blindness had been increasing day by day until now. When we talk about the night blindness and VAD in less than 5 years age of children. At that time their disease level was 4 time higher than the previous one and 23% severely deficient was observed in urban and rural cities of Pakistan. These studies was also observed the trends of the wasting, stunting and underweight in which their length, height, weight and age were included in the children. That indicate the body mass index of children and their range were different in adults by over increasing their weight and height which were the major cause of the malnutrition and lead to the night blindness in Pakistan. In Pakistan the malnutrition and poverty is very common and spreading in the four provinces Punjab, Sindh, Khyber pakhtunkhwa and Baluchistan. Beside this malnutrition may cause many chronic and severe disease like stunning is the chronic disease, underweight is acute chronic disease, and on the other hand wasting is the combination of the acute and chronic malnutrition. That's why National nutritional survey of Pakistan in the 2011 to 2016 also studied that night blindness is because of the body mass index that was using the access malnutrition in children and pregnant women.

According to the study of [Khalid.S et al 2020] about 1/3 of the whole world population is facing the problems of minerals, vitamins and micronutrients deficiency which is named as the hidden hungers and these nutrients are the vitamin A, B,C,D and so on, zinc, iron, and iodine (Stevens et al., 2015). These data has been observed that those cities of Pakistan who have low income, in which most of the children are less than 5 years age approximately 250,000 to 500,000 having the vitamin A deficiency disease like night blindness (Thompson and Amoroso, 2014). (State of the World Report 2015) In Pakistan, among the 7% of mothers and 13% of preschool children was vitamin A deficient. Among 59% to 79% mothers were not aware about the consequence of nutrients deficient. 8% children were mention about the night blindness due to the vitamin A deficiency. (Tanumihardjo et al., 2016).

Night blindness is the scarce restoration of the rhodopsin which is the associated with the VAD. Retinitis pigmentosa and stationary congenital night blindness is the major causes of the night blindness which affect the very young aged children and third trimester of pregnant women (Congdon et al., 2003). But this diseases can be resolved by the systematic vitamin A supplementations. There are many other disease conjunctiva xerosis, Bitot's spots, xerophthalmic fundus, corneal xerosis, corneal ulceration/kerotomalacia, Autism, anemia all are the VAD disease.

4) Gene mutations RDH5 causes the night blindness in Pakistan family:

According to the study of [Sultan,N 2018] in the whole world there were 3000 to 5000 people affecting with the Retinal pigmentosa the most wide spreading retinal disintegration which causes the night blindness color blindness and all other visual disease that damaging the eye retina [Rosenberg 2003; Veltel et al. 2008]. This is also an heterogeneous inherited disease and may causes by the vitamin A deficiency. This impairment disease may be due to the decreasing supply of the 11 cis- retinol to the cones which is coming from our diet (vitamin A diet like meat fish etc). If these diet were not taken properly then, no supply of the retinol and retinal in the retina and cannot make the rhodopsin. Rhodopsin is the major source of visual image in our eye and we can see anything properly. But it may be dysfunctional because of gene mutation in the rhodopsin and vitamin A deficiency [Ferrari et al. 2011].This may be irreversible blindness disorder if we did not

treat this in early stage [Marigo 2007]. This can be treated or slow down the process of disorder by vitamin A therapy, light protection through sunglasses, high oxygen level and docosahexaenoic acid is also given to the patient with vitamin A that slows down the progressions of the disorder of blindness and other genetic counseling and better therapeutic inventions [Wen et al. 2016]. In this case we can use the bioinformatics prediction tools to find out the gene, protein name, protein length, domain for functions, motif for its structural analysis and see the mutation, deletion insertion gapping and miss match of the nucleotide, protein functions their introns and exons, amino acids nucleotide and gene expressions their family. We can analysis the phylogenetic tree of that particular proteins and genes. [Liu et al. 2015], [Chader et al. 2009].

5) Night blindness among school going children in KPK (Nowshera city) Pakistan:

According to the study of the [Mohsin, Saima et al, 2015], among the refugee children there was increasing risk of the mortality and night blindness which is the major issue of the Vitamin A deficiency, it's not like that they were dying from this night blindness but many around 85 million school age children were affected by this kind of disease. It may cause the metabolic dysfunctions, immune system dysfunctions, diarrhea and fever etc. These were caused by a big flood in Pakistan in 2010. Food supplementations were given to the children 1 -6 year age but there were no any supplementation programs for the children 7 to 15 years who are suffering from the vitamin A deficiency and increase the risking factors of night blindness during the flood 2010. They also reported in their study about the comparison between the children who had not experienced flood with the school going children who had affected with the flood areas. They took the blood samples from each schools of Nowshera (KPK) total 360 children were selected and enrolled from different areas and schools between the ages of 7 – 15 years. In the result among the 190 children were affected by the flood and had a vitamin A deficiency but nearly 165 children were not affected from the flood, they were safe and sound and stayed in their house with their families.

Relationship between different vitamin A levels and percentage of children in Nowshera(KPK). Table 1:

Vitamin A status	Total percentage of children in Nowshera (KPK) affected or unaffected by flood
Normal vitamin A level(affected) flood	13(6.8%)
Normal vitamin A level(unaffected)	40(24.5%)
Low vitamin A level (affected)flood	141(74.2%)
Low vitamin A level (unaffected)	113(69.4%)
Vitamin A deficiency (affected) flood	36(18.9%)
Vitamin A deficiency unaffected flood	10(6.1%)

Relationship between vitamin A deficiency and night blindness: Table 2:

Night blindness	Total Number Of children	Vitamin A deficient	Vitamin A Low	Vitamin A Normal
Self- children	16	3	10	3
Family history	28	3	19	6

6) Demographic and health survey in Punjab and Sindh for night blindness among the children and mothers:

According to the health and demographic survey of the 2006 or 2007 [Jafree, S.R 2015] collecting and monitoring the data of women health and nutritional management and their analysis. They observed that the birth weight in kilos of the child due to the employed mother in paid work, these mothers were also very weak due to the burden of their work, especially for the pregnant and lactating women. There were many measurements variables. 1) socio demographic in which 9 different components included in analyses, maternal age between 15 to 50 years, maternal educations like literacy and illiteracy, maternal occupations skilled and unskilled number of birth children, regions like urban and rural areas, provinces like Sindh, Punjab, KPK and Baluchistan, wealth status like poor middle and rich people. On the other hand in maternal variables, on the basis of literature reviews and analysis and surveys [Chatterjee, M et al 2007]. There were no any skilled health care nurses and health workers, there were no any specific spaces delivery of the child like hospitals and safe home, due to the vitamin A deficiencies that had the experience of the night blindness and Color blindness. As a

result of this survey the report of the low birth weight of child in Pakistan was about 36% but majority of the employed mother in paid work in the Punjab and Sindh are about 42% and 39.4% respectively. Because in these two cities of Pakistan (Punjab and Sindh) had illiteracy, unskilled work, ignorance, no facilities, malnutrition, no proper food, no healthy environment, urban and rural areas [Hamid, A et al 2011]. Most of the mothers about 70% are facing the headache problems 44%, iron 62% and calcium 59% deficiency and vitamin A deficiency, that's why they were experiencing the night blindness 67% during the pregnancy that will ultimately transfer to their children. They finally find out the risk factors of EMPW, LBW headache and night blindness were greater in the Punjab and Sindh as compare to the KPK and Baluchistan, the major reason was that of there were a NGOs and international programs, women's development organizations, vitamin A supplementations, distribution of the nutrients and increasing awareness in these regions [Siza, J. (2008)].

7) Frequency of Color or night Blindness in Tertiary Care Eye Hospital.

According to the study of the [Khan, S et al 2021] color vision, color blindness and night blindness is the most common and wide spreading disease which is caused by the mutation in the gene and chromosomes of X linked deficiency in the male. Due to the missense of the opsin gene mutation. These kind of disease and blindness are observe in the different fields like fighting arms, Aviation, railway fields, police, navigation and firefighting services are facing the vision blindness, vitamin A deficiency and night blindness due to the burden of work and loss of energy, no proper diet and nutrition rich food like vitamin A [Dohvoma, et al, 2018]. This study is the totally based on the population of Pakistan in June 2018 to December 2019(in armed forces institute of ophthalmology) and observe the prevalence of the color vision impairment and night blindness for the pre-employment medical examination in a tertiary eye care hospital of Pakistan. This is basically a cross sectional study and total 1500 people are enrolled and collecting the sample by different techniques. On the other hand each candidate that were enrolled were examined by the reading plates of the Ishihara isochromatic color plates and observe the candidates who are reading properly and who are reading confusedly and they were considered to be color vision blindness and night blindness. Data were entered for further examination and analyzed in the SPSS and chi square test for the absence or presence of the night blindness or color vision. In the result most of the color vision deficient and night blindness candidates are male. Result is shown in the table.

Gender	Number of candidates	Total number	Candidate with color blindness %
Male	1325(88.4%)	70	5.28
Female	175(11.6%)	3	1.71
Total	1500	73	4.86

II. STRATEGIES

As we know that VAD had much hazardous effect on the human health. That's why we should improve our dietary nutrition by applying different strategies like treatment, preventions, diagnosing, vitamin A supplementations, food fortifications, different national nutritional surveys for knowing the total percentage of ratio of affected people year by year, different food implementation programs of government to the children, poor and needy people and improve our nutritional products by attribution of variations in our diet [Akhtar et al, 2013]. In the **treatment** section there are health treatment regarding to the night blindness in which very few amount of the fat soluble vitamin is given to the patients by the oral cavity in the form of the H₂O and retinol esters layers as the retinol palmitate because we cannot inject the vitamin A into the veins and muscles because it is the indigestible. That's why it is given by the liquid form for the 2 days on the continuous basis. If we give the high amount of the vitamin A then it can be dangerous for the vision less children and pregnant woman because of the possibility of the toxicity of vitamin A can increase the danger of birth of fetus by woman. We can add the vitamin A and all other nutrients into our food like wheat, soybeans and sugar just like the iodine incorporated into the salts to overcome the adverse effect of health in different areas of world. On the other hand this management can be very helpful for those poor and needy people who cannot afford the high amount of food like meat, fruits and cannot pay for the medical dues for the vitamin A supplements or injections. Second strategy for improving the night blindness disease in Pakistan is that improve our diet by growing vegetables, fruits and other food products in our houses or in our fields. So in this way we don't have to buy anything from markets or we don't have to face such kind of disease which is the cause of the vitamin A deficiency like night blindness, anemia and other diseases. [De-Regil et al, 2016].

1) Use of fish and herptiles in therapies of Chenab riverine area in Punjab, Pakistan

According to the study of the [Altaf, M 2020] they find out that for the skin and sexual potency disease we can use the flesh ash, oils and fats of *Aspideretes gangeticus* (soft-shell turtle). For the joint pains, muscles pain and backbone pain we can use the *Aspideretes hurum* (peacock soft-shell turtle). For the foot and toe injuries and leg problems we can use the flesh ash of *Calotes versicolor* (garden lizard). For the treatment and diagnosis of the anemia, hemorrhoids and urinary problems we can use the fats oil of the *Daboia russelii* (venomous snake). For the improvement and treatment of the night blindness, nearsightedness, fever, cold, joints pain and some other diseases we can use the head part or brain of the *Hypophthalmichthys molitrix* (silver carp Fish). Beside this we can also use the brain of the *Cirrhinus reba* (reba carp fish) and *Labeo dero* (fish family) for the treatment of the night blindness, nearsightedness, eyesight, fever, cold and joint pains. *Pethia ticto* (ticto burb fish) brain also used for the treatment of the night blindness, color blindness and eyesight

2) The Importance of Vitamin A Transport proteins in the Diet for Vision:

According to the study of [Solanki, A. K et al 2020] Biology's personal decision of dietary vitamin A as a major contributor for the essential visual chromophore (11-cis retinaldehyde/RAL) in photoreceptor cells and the vital signaling molecule (all-trans retinoic acid/RA) for retinal cell establishment and improvement stimulated selective pressure to promote an effective program of transport proteins for provitamin A/all-trans retinol/ROL absorption and collection in the constant encouragement of vision. The major transit form of sources of vitamin A in the blood is all-trans retinol (ROL) [Borel, P 2017], [Shi, Y et al 2017]. Almost all ROL is bound to plasma retinol-binding protein during transit (RBP4). RBP4 transports ROL from the liver, which is the major storage organ, to distant organs such as the eyes, brain, lungs, kidneys, placenta, and other peripheral organs that require vitamin A [Kiser, P.D 2016]. By transferring stored vitamin A to the eye, RBP4-ROL delivery, in conjunction with the RBP4 Trans membrane protein system, aids vertebrates in supporting photoreceptor cell structure and function for vision [Kelly, M, 2015]

III. SOURCES

The highest levels of functional vitamin A may be found in liver and fish oils. Milk and fowl, both of which contain some provitamin A, are important sources of this vitamin. Functionality of vitamin A The most important vitamin A is provitamin A. [Zetterström, R. (2009).]

Orange is a color that comes from lush green plants. And yellow veggies, onions, apples, and a few other fruits and vegetables veggie based oils Dairy is a good source of vitamin A. carrots, broccoli, and heavy grains; liver, fish, and heavy grains Cantaloupe and squash are two of the most common sources of vitamin C. vitamin A (provitamin). Many families of fishes like silver crop fish and herptiles like turtle lizard. Implementation of Vitamin A in diets like wheat, corn and soybeans etc.

IV. RECOMMENDATION

Awareness programs, Nutritional supplementation programs for the rural and urban areas of children and mothers. Investment in the socio demographic is needed to help the employed mothers through social media, mobiles, government, radio, and civilian efforts [McNab, C. (2009)]. Increasing the education sectors their improvement, training in the medical sectors for spreading the awareness and knowledge throughout the world as much as they could. Better monitoring in hospitals for the carefully child delivering and proper training for health workers and nurses [Feng, X et al 2011].

V. CONCLUSION

In this literature review we analyze the prevalence of night blindness due to the vitamin A deficiency in Pakistan (Punjab, Sindh, Baluchistan and KPK). We observe the different risking factors of the night blindness in children, lactating women and pregnant women. Most common reason for the night blindness, color vision impairment, nearsightedness and colorblindness disease is the vitamin A deficiency in our diet due to the poverty, illiteracy, unawareness and employed mother in paid work. This study shows different prevalence of night blindness in different cities of Pakistan. Some city like Punjab and Sindh are facing this diverse disease of vision loss, blindness, anemia and xerophthalmia. the findings of this worldwide and correlative research showed that VAD has become one of the most primary triggers of visual loss throughout the world. In current history, the general trend of time of life prevalence rates of VAD visual impairment has decreased, and VAD has manifested in a larger vision loss incidence in the post-neonatal age category and in impoverished countries HDI. From 1980 to 2019, there was a decrease in the between-country discrepancy in the transmission of something like the VAD visual decline impact. Furthermore, the findings of this research will give a much

more realistic foundation for increasing adequate intake of vitamin and other nutritional food and building successful VAD health promotion programs, vitamin supplementation programs, educations and training for the nurses and schools, colleges particularly for children in poor countries like Pakistan.

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