

Color Blindness among Potential Military Recruits in Riyadh, Kingdom of Saudi Arabia

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Abstract: Background: Color blindness or Color Vision Deficiency (CVD) is X- linked recessive, characterized by decrease ability to perceive the difference between colors. The main aim of this paper was to determine the prevalence rate of color blindness among new military recruits in Riyadh, Kingdom of Saudi Arabia (KSA). **Methods:** A retrospective review of the medical records of 2310 young adult underwent screening and examinations for military service between August 2013 and November 2013. Ishihara color test plates were used to diagnose color blindness among participants. Findings were grouped into three groups based on the month of examination. Data entered into SPSS, cleaned, tabulated and statistically analyzed. The prevalence of color blindness among the new recruits was determined. **Results:** A total of 2310 young adult were enumerated and 2057 (89.1%) were examined. Among the studied sample 39 (1.9%) out of 2057 were unfit for military service due to color blindness with mean age of 22.7±3.7 SD years (range 18-30 years). The prevalence of color blindness was found to be 1.90% (1.35—2.60) with 95% CI. **Conclusions:** The prevalence of color blindness among male young recruits was low compared with other studies in the country and around the world.

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Background

Color blindness or Color Vision Deficiency (CVD) is X- linked recessive character, inherited due to hybrid gene which codes the green and red color, it's more common among male than female[1, 2]. The disease is characterized by decrease ability to perceive the difference between colors and inability to see certain colors such as the green, red or blue[3]. It could be complete color blindness or monochromic when all the cone pigments are missing or dichromic when the red retinal receptors are missing[4]. Ishihara color test plates or charts are used to diagnose color blindness which is one of the reasons for rejection from military services[5]. Many literatures suggest a pass in Ishihara test is a must in joining military services in developed and developing countries[6, 7].

All potential military recruits in Saudi Arabia are subjected thorough medical and physical examinations including color vision test at Almorooq Heath Center in Riyadh city. It is the focal point for screening all potential military recruits into the Saudi Arabian military service. Recruitment eligibility for military service includes healthy vision which plays important role in performance of duty and safety.

Several studies have reported different prevalence rates of color blindness among military

populations word wide[8, 9]. Published studies about the prevalence of color blindness among military recruits in Saudi Arabia, Gulf countries and entire Middle East are rare[10]. In recent years it has been noticed that color blindness is one of the key reasons for rejection of many new recruits from joining the military services in Saudi Arabia. The gap in knowledge about the actual prevalence of color blindness among military recruits in Riyadh city and the entire gulf region was the main reason for conducting this study. The main objective of this study was therefore to determine the prevalence rate of color blindness and compared it with other rates in the region and worldwide.

Methods

Setting

A retrospective review of medical records of potential military recruits in Almorooq health center was performed. The health center provided community and family health services to the populations of Ministry of defense in Saudi Arabia. It is located in the heart of Riyadh city and considered as the focal point for screening of new military recruits from all over the country. It is equipped with highly qualified medical staff and the latest medical

equipment. Potential recruits for military service were examined on daily basis (Sunday – Thursday) from 8 am to 3pm. Ophthalmological examinations were conducted by consultant ophthalmologist with assistance from a trained nursing staff.

Participants

In total 2310 male recruits were examined for military service between 1/8/2013 and 1/11/2013. All the medical records of military recruits during the three month period were retrieved and analyzed. Only participants who were examined for recruitment into military services between 1/8/2013 and 1/11/2013 were included. The participants were divided into three groups based on the month in which participants were examined for military service. Two hundred and fifty three records with incomplete data were excluded from the study. The remaining 2057 (89.1%) records had complete data were analyzed.

Statistical Analysis

Participant's data were entered into SPSS version 16 for windows, pre-processed, cleaned and managed. Descriptive statistics such as mean, median and standard deviations, frequencies and percentages were calculated. The prevalence rate of color blindness was calculated by dividing the number of cases of color blindness by the total number of participants [11, 12]. The 95% Confidence Interval (CI) were calculated with Wilsons method for binomial proportion[12].

Ethical consideration

Ethical approval for this study was obtained from the Medical Services Department in Ministry of Defense (MSD) and research ethics committee in Prince Sultan Military Medical City (PSMMC) in Riyadh with approval number 596.

Results

Out of the 2140 male new military 39 prevalent color blindness cases were identified. Baseline descriptive statistics of color blinded cases are presented in table 1.

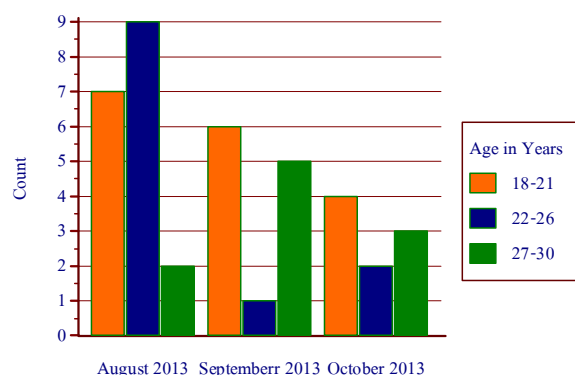


Figure 1: Color Blindness Over Three Month Period

Table 1: Descriptive Statistics of Color Blindness by age (n = 39)

| Age-group | Color Blinded | Min | Max | Mean(95%CI) | Median | SD |
|-----------|---------------|-----|-----|--------------------|--------|------|
| 18-21 | 17(43.59%) | 18 | 20 | 19.22(18.71-19.73) | 19.00 | 0.67 |
| 22-25 | 12(30.77%) | 22 | 26 | 23.33(22.25-24.42) | 23.00 | 1.41 |
| 26-29 | 10(25.64%) | 27 | 30 | 27.67(27.00-28.33) | 27.00 | 0.87 |
| All | 39(100%) | 18 | 30 | 22.72(21.51-23.92) | 22.00 | 3.72 |

Min =Minimum, Max = Maximum, SD = Standard Deviation

The overall prevalence rate of color blindness was 1.90; table2 shows the prevalence of color blindness in different age stratum.

Table 2: Prevalence with 95% CI of colorblindness by age (n = 2057)

| Age-group | Participants | Color Blinded | Prevalence(95%CI) |
|-----------|--------------|---------------|-------------------|
| 18-21 | 929(45.16%) | 17(43.59%) | 0.83(0.48—1.32) |
| 22-25 | 652(31.70%) | 12(30.77%) | 0.58(0.30—1.01) |
| 26-29 | 476(23.14%) | 10(25.64%) | 0.49(0.23—0.89) |
| All | 2057(100%) | 39(100%) | 1.90(1.35—2.60) |

Number of color blindness in different age group over the three month period (August 2013, September 2013 and October 2013 are presented in figure 1.

The prevalence rate was found to be 1.90 (1.35-2.60) 95% CI was compared with the prevalence rate obtained other studies in table 3 below.

Table 3: The Prevalence Rate of Color Blindness in Other Studies

| Study Title | Study Population | Age Range | Sample Size | Prevalence | Country | Reference |
|---|----------------------------------|---------------|-------------|-----------------|--------------|-------------------|
| Color vision screening among Saudi Arabian children | Elementary/high school | 6 to 19 years | 1638 | 5.85% | Saudi Arabia | O Matthew[13] |
| Prevalence of congenital color vision defects in Saudi Female of Arab Origin | Secondary school | | 7467 | 0.35% | Saudi Arabia | Alabdalmomean[14] |
| Ocular findings among young men: a 12-year prevalence study of military service in Poland | Men in Military Service | 18—34 Years | 991 | 13.2% | Poland | Michal[15] |
| Prevalence of color blindness in Northeastern Tanzania | <i>Secondary School students</i> | 15—20 Years | 1822 | 5.89% | Tanzania | Gabriel [16] |
| Prevalence of congenital color blindness among Inuit in East Greenland | Young Men | 7—36 Years | 1085 | 2.67 | Denmark | Mogens[17] |
| Refractive Error and Visual Impairment in African Children in South Africa | School age | 5 to 15 years | 5599 | 2.9% | South Africa | Naidoo[18] |
| Refractive Error and Visual Impairment in Urban Children in Southern China | children | 5 to 15 years | 5053 | 3.3% -- 5.7% | China | He[19] |

Discussion

Colors blinded are considered to be handicap and have to adapt for everyday life since it is one of the well documented functional disorders. This disease also prevents many new recruits from joining the military service worldwide. Military personals have color vision standards that apply to a wide range of jobs within the military which need to be considered. Abnormal vision such as color blindness can seriously affect their daily activities. But not all normal color vision may be required for critical occupations among military service men, such as aircraft pilots, computer operated heavy weapons and officers and deck crew in the air force.

The present findings show that, the prevalence of color blindness is low(1.9%) among male recruits in Riyadh as compared with similar study among elementary and secondary school populations(5.8%) in Saudi Arabia [13]. The prevalence rate in our study is decreasing with increase in the age of participants as shown in table 2 above. Participants with age stratum 18-21 years had a prevalent of 0.83% compared to 0.495 in the age stratum 27-30 years old.

On the other hand the prevalence rate calculated in the current study is higher than the prevalence of color blindness among Saudi female (prevalence 0.35%)[14] this support other studies worldwide which show that the prevalence of color blindness is less in female compared to their male counterpart[9]. Less number of females are color blinded due to the fact that the disease is X-Linked recessively inherited[20]. The current results are also lower than the ones found in Poland, Denmark, Tanzania, South Africa and China as presented in table 3 above.

Even though the prevalence rate for color blindness was found to be significantly low in this study, it has stopped many young men from achieving their dreams of joining the military service in Saudi Arabia as such more urgent studies on this vital issue and other related X –linked diseases become necessary.

Conclusion

The prevalence of color blindness among young military recruits is low compared with other studies conducted worldwide. We suggest other multicenter long duration cohort studies; this will help develop

future policies for the early detection and treatment of the diseases

Competing interest

The authors has no conflict of interest

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