Refractive trends in Swedish Military recruits

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Abstract
Purpose: The aim of the study was to determine the prevalence of refractive errors in military recruits, with special reference to myopia.
Methods: 651 male military recruits, 17-23 years of age, were refracted at Pliktverket in Näsby (a National Service Administration office near Stockholm, Sweden). The refractive measurements were taken with a Topcon KR-7OOOP auto keratorefractometer during the initial health examination of National Service recruits.
Results: Out of the 651 recruits the prevalence of myopia (≥-0.50DS) was 37.7% (i.e., both eyes being myopic). The mean refractive error was RE -0.47DS and LE -0.41DS. This difference was not statistically significant.
Discussion: The prevalence of myopia in Swedish military recruits has increased from 8.9% to 37.7% and the mean refractive error has changed from +0.53DS to –0.44DS since the study of Strömberg (1936). However, the prevalence of myopia in these present day recruits is lower than the 49.5% found in 12-13 year old Swedes (Villarreal et al., 2000).

Key words: myopia – prevalence – Swedish male military recruits

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Sammanfattning
Bakgrund: Målsättningen med studien var att undersöka prevalensen av synfel hos mönstrande män med fokus på myopiprevalens.
Metod: 651 värnpliktiga i åldern 17 till 23 år blev undersökta vid mönstring hos Pliktverket i Näsby utanför Stockholm. Mätningarna utfördes med en Topcon autorefraktor (KR-7000P) som del av deras hälsokontroll.
Resultat: Av de 651 värnpliktiga som undersöktes påträffades en myopiprevalens (≥-0.50DS) på 37,7%. Det genomsnittliga synfelet var HÖ –0,47DS och VÖ –0,41D, en skillnad som inte var statistisk signifikant.
Diskussion: Myopiprevalensen hos mönstande män i Sverige har ökat från 8,9% til 37,7% och det genomsnittliga synfälet har ändrat sig från +0,53D till –0,44DS sedan motsvarande studie genomfördes av Strömberg (1936). Samtidigt ser man att myopiprevalensen hos dagens mönstrande män är lägre en myopiprevalensen (49,5%) som hittades hos svenska 12-13 år gamla barn (Villarreal et al., 2000).

Introduction

There is general agreement that the environment and genetics interact in the development of myopia (Adams and McBrien, 1992; Chung et al., 1996; Cordain et al., 2002; Mutti et al., 1996; O'Hara and Nelson, 1997) and that some populations, particularly in the Far East, are markedly predisposed to myopia (Hosaka, 1988; Lin et al., 1988; Saw et al., 2005; Wong et al., 2000; Zhao et al., 2000), but there is also evidence of increased prevalence of myopia in other parts of the world (Bar Dayan et al., 2005). The theory of myopia as an environmentally induced physiological adaptation to near work has lately been gaining more support (Adams and McBrien, 1992; Cordain et al., 2002; Flitcroft, 1998; Kinge and Midelfart, 1994; Kinge et al., 1998, 2000; Nyman 1998; Midelfart, 1990; Midelfart et al., 1992; Mutti et al., 2002; Saw et al., 2002; Williams et al., 2008), while the Sydney Myopia study recently reported that near work was not associated with concurrent myopia (Ip et al., 2007). From twin studies evidence has been presented that indicates that myopia is 80-90% heritable (Hammond et al., 2001; Lyhne, et al., 2001), however, family aggregation studies suggest lower heritability (Framingham Offspring Eye Study Group, 1996). Furthermore, the observed large changes in prevalence over very few generations have again illustrated the importance of environmental factors (Morgan and Rose, 2002). In general, recent research can be summarized by saying that both environmental and genetic factors are of importance in the development of myopia, but that it is still to be discovered how these factors interact in order to explain the increase in myopia that can be seen in different parts of the world.

In the Nordic countries the prevalence of myopia is reported to be approximately 30% (Fledelius, 1983; Fledelius, 2000; Kinge et al., 1998; Midelfart, 2004). A summary of Nordic studies into the prevalence of myopia can be found in *Table 1.*

In 1936 Strömberg, based on subjective refraction, found the prevalence of myopia in 2616 Swedish conscripts aged about 20 years to be 8.9%. Since the study of Strömberg (1936) no study has been conducted in Sweden in order to determine the prevalence of myopia in a population of similar age. The aim of the current study was to determine the prevalence of today's Swedish army recruits and to compare the results with those of Strömberg (1936).

Table 1: Prevalence of myopia as found in the Nordic countries

Country	Author	Definition	Age group	Prevalence of myopia
Norway	Holst & Tjåland (1962)	?	9 years	2.2%
			12 years	5.9%
	Midelfart et al. (1992)	≥-0.25	Medical students	50.3%
	Midelfart et al. (2004)	≥-0.50	20-25 years	35%
Denmark	Øster & Kjærgaard* (1964)	≥-0.25	7-8 years	1%
	Engbæk* (1970)	≥-0.25	7-8 years	1.2%
	Johansen* (1950)	≥-0.25	9-11 years	7.4%
	Fledelius (1976)	≥-0.25	9-11 years	9.3%
	Jensen (1991)	≥-0.25	7-12 years	28.6%
	Øster & Kjærgaard* (1964)	≥-0.25	13-14 years	10%
	Goldschmidt (1968)	≥-0.25	13-14 years	9.5%
	Engbæk* (1983)	≥-0.25	13-14 years	11-12%
	Goldschmidt (1968)	≥-0.25	17-23 years	14.5%
	Fledelius (1980)	≥-0.25	17-23 years	13-14%
	Fledelius (1983)	≥-0.25	17-23 years	32.6%
	Fledelius (200)	≥-0.50	22-41 years (median 26 years)	50.0%
Finland	Heinonen (1934)	≥-0.5	14-15 years	12%
	Laatikainen & Erkkilä (1980)	≥-0.5	7-8 years	1.9%
			11-12 years	7.2%
			14-15 years	21.8%
	Mäntyjärvi (1983)	≥-0.25	12 years	14%
			15 years	22.8%
Sweden	Villarreal et al. (2000)	≥-0.5	12-13 years	49.7%
	Lundgren (1954)	?	18-19 years	19.5 - 25.3%
	Strömberg (1936)	≥-0.25	20 years	8.9%
		≥-0.75	(all men)	6.4%
		>-1.0		4.7%
	Stenström (1947)	≥-0.25	20-35 years	27%
		>-1.0		16%
	Present study	≥-0.5	17-23 years (all men)	37.7%

Subjects and Methods

A total of 651 men aged between 17 and 23 years (mean age 18 years) was examined. The ocular examination was an additional and voluntary part of the initial health examination for National Service recruits. The examination took place at Pliktverket in Näsby (a National Service Administration office near Stockholm, Sweden). All recruits enrolled over a one week period were examined consecutively, all recruits accepted to be part of the study and none of the enrolled recruits were excluded. The recruits came from the greater Stockholm area. Of the 651 tested 98.5% were of Caucasian origin. All subjects gave informed consent.

All subjects had their visual acuity measured with a 4 metre LogMar chart. The refractive error was determined by use of a Topcon KR-7OOOP (auto kerato-refractometer) without the use of cycloplegics. As a safeguard against proximal effects prior to the auto-refraction all subjects were asked to fixate an acuity chart placed 4 metres away in order to relax accommodation.

All statistics were performed using InStatTM (GraphPad, La Jolla, CA, USA) and OriginTM (Origin Lab, Northampton, MA, USA) statistical software. Comparison of the present data and the results of Strömberg (1936) was done using Chi-squared test. The range of refractive errors could be considered normally distributed and the 95% confidence interval of the mean was constructed using the Student T-test.

Results

Classification of refractive error was based on spherical equivalent (spherical value combined with half the cylinder value) and was divided into three groups: myopia (≥-0.50D), hyperopia (≥+0.50D), and emmetropia (+0.50D < spherical equivalent <-0.50D).

Myopia: of the 651 recruits examined the overall prevalence of (≥-0.50D) was 37.7%. The prevalence of right eye myopia was 39%.

Hyperopia: (>+0.50D) the overall prevalence was 19.6% and right eye prevalence was 17.8%.

Emmetropia: an overall prevalence of 42.7% with a 43.2% prevalence in the right eye.

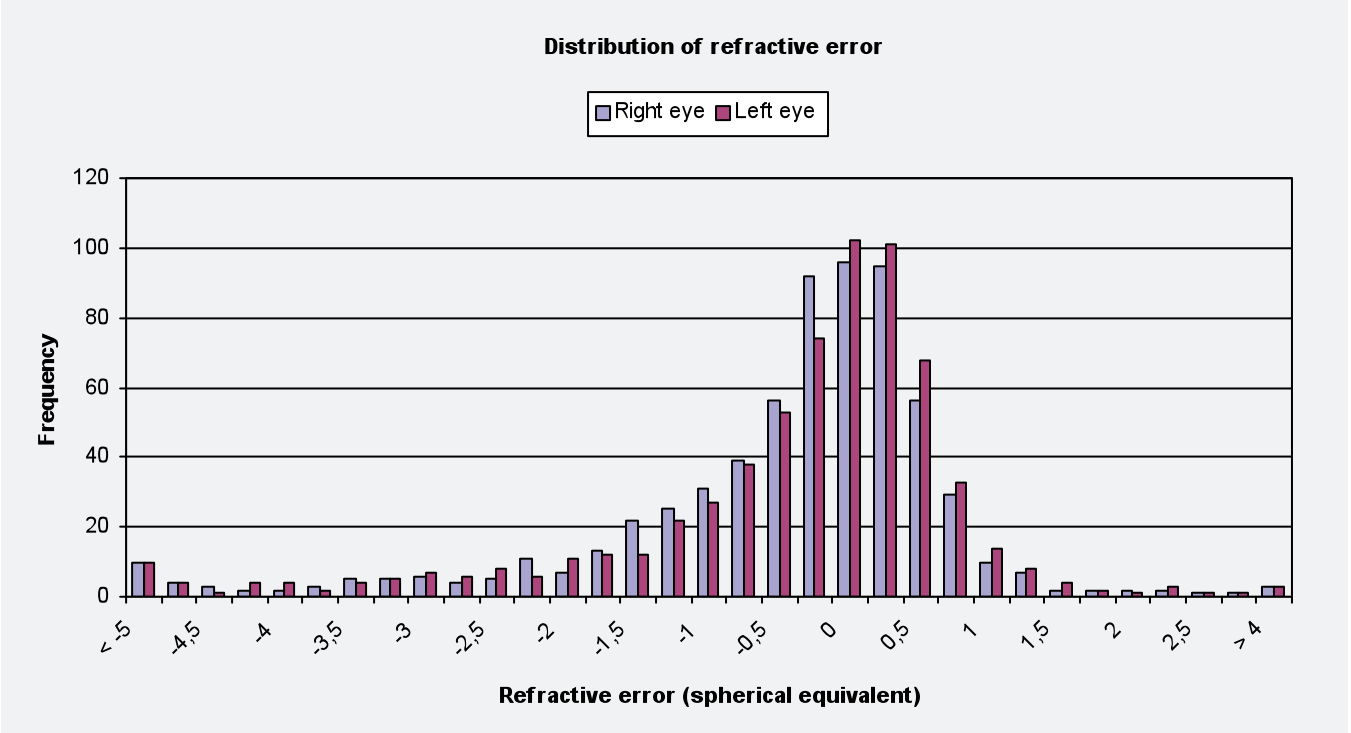
The mean refractive error for the right eye was -0.47D (±0.14; 0.95 confidence interval of the mean) and for the left eye -0.41D (±0.14; 0.95 confidence interval of the mean).

The highest refractive errors were -8.25D and +6.50D. The distribution of refractive errors can be seen in *Figure 1*.

Discussion

The subject group examined in this study is similar to the group examined by Strömberg (1936) in that they are all male, of similar age, and predominantly Caucasian (98.5%). This implies that the prevalence of myopia over a three-generation period (65 years) has increased from 8.9% to 37.7% ($p<0.05$), and the mean refractive error has changed from +0.53DS

Figure 1: Distribution of refractive error (spherical equivalent) in the right and left eye



to –0.44DS ($p<0.05$). However, there are several factors that should be kept in mind when comparing the present study with the data of Strömberg (1936). Strömberg's data are based on subjective refraction without the use of cycloplegics whereas the present data are based on auto-refraction without the use of cycloplegic drugs. Both methods may overestimate the prevalence of myopia since both lack proper control of accommodation. However, Midelfart et al. (1992) found no significant difference between the spherical equivalent measured with an auto-refractor and that measured with subjective refraction, something that implies that the results are comparable.

The aim of the present study was to determine the prevalence of myopia in today´s Swedish army recruits and to compare the results with the results of Strömberg (1936), and not to determine any cause for the development and/or increase in myopia. However, large changes in "normal life" have happened since Strömberg's time. In 1936 normal education lasted for 6 to 9 years. For the subjects in this study the average number of years of education was about 12 years. In addition to the increased reading implicit in extended education the popular present day near vision activities such as watching TV, video games and computers did not exist at the time of Strömberg.

It is interesting to note that over the same time period the average height of Swedish 18 year old men enrolled for National Service has increased by 2.3% (from 175.9 to 179.9 cm), while the average weight has increased by 22.1% (from 60.3 to 73.6 kg). This is an increase in body mass index (BMI) of 16.5% and is presumably a reflection of an increasingly sedentary lifestyle. (Height and weight data is extrapolated from statistical material published by Pliktverket (2002).)

The prevalence of myopia (49.5%) found by Villarreal et al. (2000) among Swedish 12-13 years old teenagers is much higher than our results for 17-23 year olds and those from other Nordic countries. It remains to be seen if this presages increasingly high levels of myopia in future generations of Swedes.

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