A study on the prevalence of high cholesterol among aircrew members of Sri Lanka Air Force

ANH Mendis [1#], A Balasuriya[2]
[1] *Sri Lanka Air Force*
[2] *General Sir John Kotelawala Defence University*
[#]For correspondence; niluhimali20@yahoo.com

Abstract— Flying involves a complex interaction between the aviator and a sophisticated machine in a highly challenging environment. Thus the physical fitness of aircrew should be maintained at the highest level when flying an aircraft. Physical health of the aviators can be challenged by group of diseases known as noncommunicable diseases which is highly prevalent in Sri Lanka. The focus of this research is to study the occurrence of dyslipidemia and associated risk factors among the air crew members of Sri Lanka Air Force (SLAF). Data collection was carried out by self-administered questionnaire among 100 volunteered air crew members and using the records available on their medical folders at their consent. Study finds that among the population under study, 38% having high total cholesterol, 70% having high LDL levels and 16% having low HDL levels. Prevalence of high LDL level is found to be at an alarming high level in this sample and the only statistically proven contributing risk factor (P=0.048) was deduced to be the consumption of food with high lipid content. The results of this research will be a useful for planning and implementation of relevant programs in SLAF in maintaining the proper health conditions in air crew members.

Keywords—Dyslipidemia, High Cholesterol, Air Crew, SLAF

I. INTRODUCTION

Flying is a highly skilled job involving complex interactions between the aviator and the sophisticated machine in a strange environment. It is this imperative threat that physical and mental fitness of aircrew be maintained at the highest level for flying modern combat aircraft.

Stringent Aircrew medical examination (ACME) of Aircrew is mending to identify potential causes of medical incapacitations or disability with bearing on physical fitness. Medical disabilities in an Aircrew may lead to temporary unfitness from flying duties or permanent cancelation of flying license. High challenge is persistence for group of diseases known as noncommunicable diseases (NCD)which in case of an air crew may affect flying fitness. High cholesterol thus has the potential to not only impairing the performances of air crew and jeopardize the flight safety but also compromise there employability.

Dyslipidemia is a primary, major risk factor for Coronary Artery Diseases (CAD) and may even be a prerequisite for CAD, occurring before other major risk factors come into play(Turner et al., 1998). In Sri Lankan population Dyslipidemia was the most prevalent (87.3%) risk factor as independent risk factors for the coronary artery disease (CAD) disease (Herath et al., 2010)

The prevalence of dyslipidemias varies according to the ethnic, socioeconomic, and cultural characteristics of distinct population groups due to ethnicity factors, working environment, geography, and lifestyle (Ujcic-Voortman et al., 2010).

The prevalence of hypercholesterolemia (>5.2mmol/L),Low Density Lipid(LDL)(>3.4mmol/L), low High Density Lipid (HDL)(<1.0mmol/L) and high Triglyceride (TG) (1.7mmol/L) were 53.6%, 24.7%, 53.1 %, 22.7% respectively in Sri Lankan population according to research data in 2010 among nationally representative sample of 5000 subjects over 18 years by a multistage random cluster sampling technique. The means (SD) of TC, HDLC, LDLC and TG were 5.35(1.13), 1.21(0.28), 3.51(0.97) and 1.38(0.75) mmol/l. It shows a high prevalence of Dyslipidemia among Sri Lankan adults (Herath et al., 2010).

Indian Council of Medical Research–India Diabetes (ICMR-INDIAB) study which covered a population of 213 million people using stratified multistage sampling design found that 13.9% had Hypercholesterolemia, 29.5% had Hypertriglyceridemia, 72.3% had low HDL-C, 11.8% had high LDL-C levels and 79% had abnormalities in one of the lipid parameters (Joshi et al, 2014).

South Asians around the globe have the highest rates of CAD, with a higher risk at younger ages and are accompanied by low or similar rates of major traditional risk factors (Enas et al., 2007).

Among South Asian population Mean serum cholesterol (180-200 mg dl -1), obesity (5-8%) and dietary fat intake are paradoxically lower and do not explain the cause of increased susceptibility to CAD and Diabetes. The force of lipid-related risk factors and of higher body mass index appears to be greater in people of South Asian origin owing to the presence of central obesity, insulin resistance, low high-density lipoprotein cholesterol, higher lipoprotein(a), decreased beta-cell function, in-utero under nutrition, deficiency of antioxidants and higher levels of angiotensin-converting enzyme.(Singh et al., 2001).

According to American heart association 31.7% in the United States have high LDL and 12.9% are having high TC. Less than half (48.1%) of adults with high LDL cholesterol are getting treatment to lower their levels (Mozaffarian et al., 2014).

Because of their special working environment, Dyslipidemia is more harmful to aviators than to people in the general population (Davenport et al., 2015) . Dyslipidemia may leads to aero related diseases, such as vertigo, syncope, and flight illusion, which could be dangerous during flight. Indeed, nearly half of grounded aviators are grounded due to cardiovascular disease, a condition which correlates with Dyslipidemia (Liu et al., 2011).

Endocrinology and Diabetes Mellitus occupy a significant prevalence in clinical aviation medicine, leading to flying restrictions in large proportion of referred patients. (Gifford et al., 2015).

A retrospective cohort analysis of all military aircrew, airspace managers and rear crew aged over 59 years referred for Enhanced Cardiovascular Screening (ECS) programme, Cardiovascular risks identified included: smoking (active 3.9%, ex- smoker 16.7%), Hypertension (34.5%), Hypercholesterolemia (23%), atrial fibrillation (1.3%) and a family history of acute coronary syndrome (10.3%). Military aircrews are often placed under considerable occupational stress and require a high level of physical fitness (Chamley et al., 2006).

A research done among 305 Chinese aviators those who were selected randomly and followed up from 2006 to 2011,the prevalence of total Cholesterol(TC), TG, HDL and LDL among this population was 12.13%, 1.3%, 4.43, and 45.9% and it is found that they presented with Dyslipidemia younger than other Chinese populations (Zhao et al., 2014).

II. Methodology

Characteristics of the study population

The sample size for the study is 100 subjects from the Aircrew members who have done their 2015 ACME from SLAF Hospital Rathmalana. The sample size was selected in order to obtain data of sizable number of respondents of varying categories with the limited availability of resources, would not overburden the researcher.

Sample design and procedure

Systematic sampling – 100 Aircrew members who are posted and attached to Rathmalana Base for year 2015 was taken as the sample.

Study instrument

Pretested self-administered questionnaire developed with the expert's opinion, in order to study the prevalence of Dyslipidemia and associated risk factors among the Aircrew members of Sri Lanka Air Force. The second part of the questionnaire is filled by the data available in Aircrew medical folder of each personnel.

The questionnaire developed according to SLAF Health policy on Aircrew Medical Examination, American Heart Association guidelines on Dyslipidemia, Sri Lankan Dietary Guidelines by the Ministry of Health and 10 Perceived Stress Scale on Stress. It is prepared by the investigators considering the objectives of the study. It also pre-test on ten randomly selected air crew members to verify whether they understand the questions and confirm whether that would be suitable to collect data.

Ethical consideration

Permission acquired from the Commanding Officer of SLAF Hospital Rathmalana to refer the Air crew folders at ACME of RMA and relevant Commanding Officers of the Helitours, No 4 Squadron, No 6 Squadron and No 8 Squadron to administer the questionnaire among the Aircrew members.

Informed verbal consent was obtained from all the participants before giving the questionnaire. Names or Squadron were not included in the questionnaire, only the service number asked to trace the Aircrew Medical Folder. Voluntary participation and autonomy to give consent or to refuse participation in the study or to withdraw from the study at any time despite consenting to take part earlier respected.

Inclusion and exclusion criteria

Aircrew members who were posted and attached to Rathmalana Base for the year 2015 used as inclusion criteria.

Aircrew members who were on foreign mission, on local or foreign training, who were holding an administrative appointment without flying at the time of administering the research questionnaire and all the cabin attendants and stewards were excluded from this research.

Data analysis

Data were processed and analysed by using IBM SPSS Statistics 20.

III. RESULTS

Sociodemographic characteristic

The research was carried out by obtaining data from 100 Aircrew subjects covering almost all the Aircrew professions. All are male aircrew members.

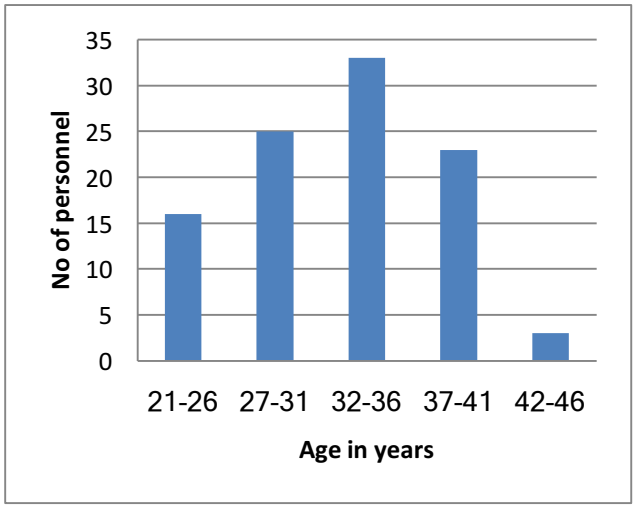

Figure 1.Age distribution of the sample

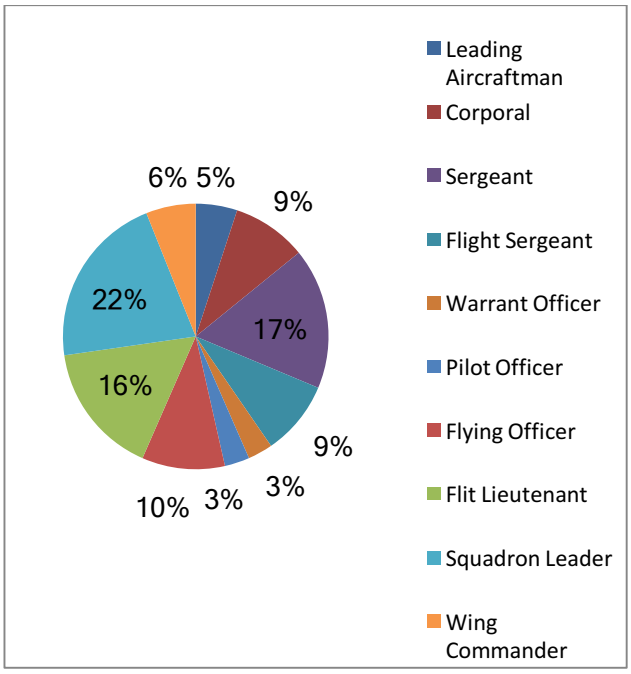

Figure 2.Rank distribution of the sample

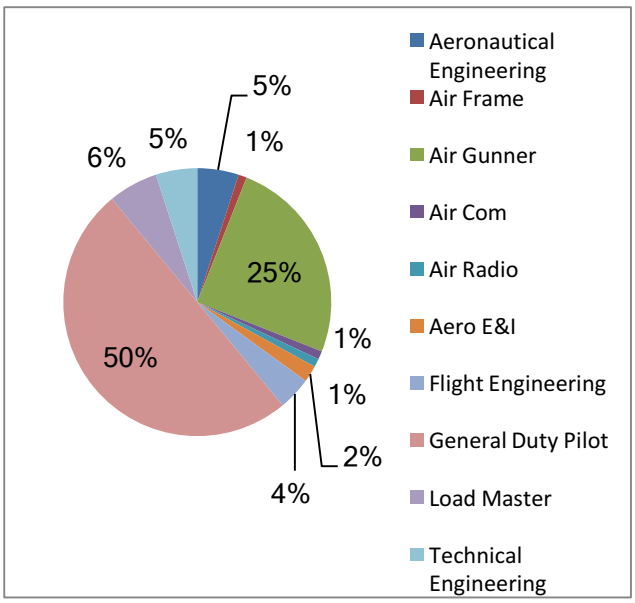

Figure 2.Branch/Trade distribution of the sample

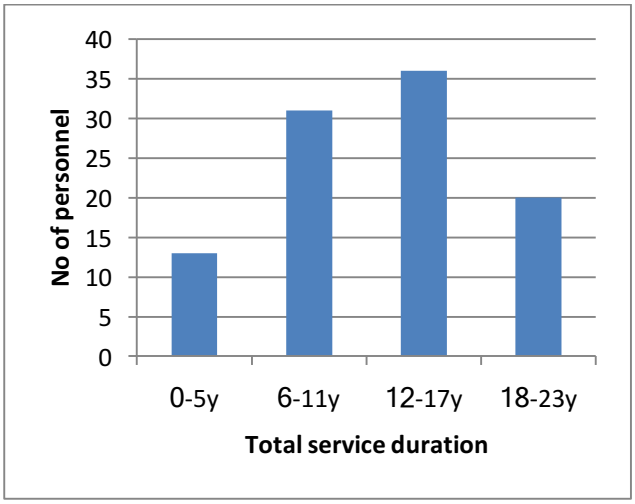

Figure 3.Distribution according to the service duration

Known risk factors for Dyslipidemia

The table 1 shows statistical analysis between known risk factors and total cholesterol level. The only statistically proven known risk factor for Dyslipidemia in this sample is high intake of diet with high fat levels. It shows by this research that there are relationship between smoking, alcohol consumption, positive Family history (FHx) of non-communicable disease and high Body Mass Index (BMI) as risk factors for Dyslipidemia in this population but it is not statistically proven in this sample.

Eventhough high intake of egg yolk and Stress level are high in this sample, it is not correlating as a risk factor for Dyslipidemia in this population. The physical activities are also not correlating as a risk factor for Dyslipidemia in the sample.

Table 1.Statistical analysis between known risk factors and total cholesterol(TC) level of the lipid profile

Known Risk factor		TC<200mg/ dl	TC>200mg/ dl	**Significance**
Smoking	Smoker(40)	24(60.0%)	16(40.0%)	χ2 =0 .113, df =1, p =0 .737
	Nonsmoker(60)	38(63.3%)	22(36.7%)	
Alcohol	Alcoholic(65)	38(58.5%)	27(41.5%)	χ2= 0.987, df=1, p= 0.320
	Non-Alcoholic(35)	24(68.6%)	11(31.4%)	
Family history	No FHx of NCD(69)	47(68.1%)	22(31.9%)	χ2= 3.534, df=1, p = .060
	FHx of NCD(31)	15(48.4%)	16(51.6%)	
BMI (According to AFM: MED 101,201)	Normal BMI(92)	58(63.0%)	34(37.0%)	Fisher's exact test- Exact Sig. (2-sided) 0.474, (1-sided)0 .356
	High BMI(8)	4(50.0%)	4(50.0%)	
Physical exercise	Exercise adequate(79)	46(58.2%)	33(41.8%)	χ2= 2.272, df=1, p=0 .132
	Exercise inadequate(21)	16(76.2%)	5(23.8%)	
Stress	No significant stress(56)	35(62.5%)	21(37.5%)	χ2= 0.014, df=1, p= 0.907
	Significant stress(44)	27(61.36%)	17(38.64%)	
Dietary intake of fat	High fat intake(73)	41(56.2%)	32(43.8%)	χ2= 3.908, df=1, p= 0.048
	Normal fat intake(37)	21(77.8%)	6(22.2%)	
	>3 eggs per week(43)	27(62.8%)	16(37.2%)	χ2= 0.020, df=1, p= 0.887
	<3 eggs per week(57)	35(61.4%)	22(38.6%)	
	Sausages >3 meals per week(24)	8(33.3%)	16(66.7%)	χ2= 11.015, df=1, p= 0.001
	sausages < 3 meals per week(66)	54(71.1%)	22(28.9%)	
	Pork >3 meals per week(30)	15(50.0%)	15(50.0%)	χ2= 2.619, df=1, P= 0.106
	Pork < 3 meals per week(70)	47(67.1%)	23(32.9%)	

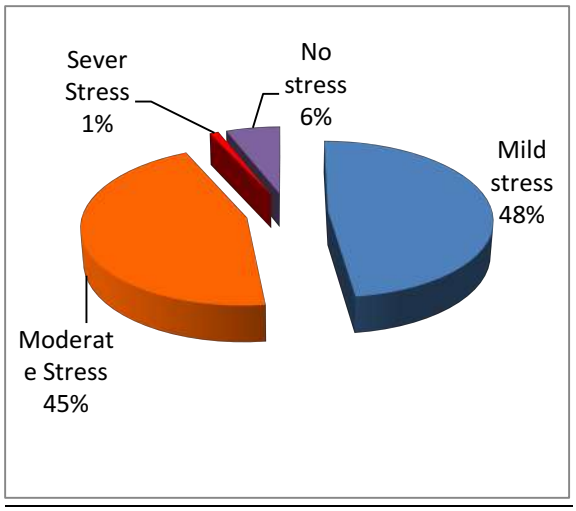

Figure 4. Stress level of the sample

In this sample of Aircrew 94% of the subjects are having Stress according to 10 Perceived Stress Scale (PSS). Out of them also 45% of the subjects are having moderate stress(Figure 1). No and Mild stress categorized as no significant stress and moderate & sever stress as significant stress. Among Pilots 98% of the subjects are having Stress. Eventhough stress is a known risk factor for Dyslipidemia it is not statistically proven nor correlated in this sample.

Analysis of the lipid profile

The prevalence rates of Dyslipidemia within this study population are, 38% having high total cholesterol, 70% having high LDL levels and 16% having low HDL levels (High Blood Cholesterol ATP III Guidelines n.d.). According to research data mean values of LDL (70%) and HDL (16%) level are not in the optimal levels of the sample(Table 2) .Six percent of the personnel are on treatment for Dyslipidemia and all of them are from GDP branch .

Table 2. Mean values of the lipid profiles of the sample

	TC	**HDL**	**TG**	**LDL**
Mean(mg/dl)	191.41	45.41	104.06	118.21
Optimal level(mg/dl)	<200	>40	<150	<100

IV. DISCUSSION

Prevalence of high LDL level is high in this target population when we compare it with Sri Lankan general population data (Herath et al., 2010), eventhough this our study population is young healthy adults. The prevalence of high TC and low HDL levels are lower than Sri Lankan general population and this may be due to this our population is selected healthy younger population when compared with Sri Lankan general population data. When these figures compared with Indian (Joshi et al., 2014), Chinese(Qi et al., 2015) and American general population data (Mozaffarian et al., 2014) Prevalance of high TC and LDL both are higher than those general populations .

Also our population prevalence rates of TC higher than the Royal Air Force military Aircrew, Airspace managers and rear crew aged over 59 years (Chamley et al., 2006) and Chinese aviators (Zhao et al., 2014).

The mean TC, LDL, HDL and TG level of this population are lower than Sri Lankan general population statistics (Herath et al., 2010), this may due to target population is younger than general population.

The prevalence of smoking and alcohol consumption is higher than general population of the country in 2015 (STEPS Survey Sri Lanka 2015). The only statistically proven known risk factor for Dyslipidemia in this sample is high intake of diet with high fat levels and other known risk factors are not statistically proven in this sample

This observation may be explained by the inadequate history data collected in the questionnaire, inadequate sampling and South Asian paradox of dyslipidemia risk factors (Singh et al., 2001, Enas et al., 2007).

In this sample of Aircrew are having high level of Stress. Aircrew needs some stress (eustress) for their optimum performance, but this is an alarming figure and a flight safety issue.

V. RECOMMENDATIONS

This research is a dire need of the air crew medical section in SLAF as it gives an assessment for on- going effort to control present known risk factors for Dyslipidemia. Hence the result of this research will be a useful for planning and implementation of relevant programs in ACME in SLAF.

Though the LDL value indicates clear association with Dyslipidemia, the Aircrew guild lines of SLAF only considered Total Cholesterol value to analyse Aircrew personal for Dyslipidemia during ACME. Therefore it is recommended to be considered LDL value also with TC during ACME to identify Dyslipidemia.

It is recommended to use Framingham Risk Score to analyse and to identify CVD risk of Dyslipidemia rather than considering one factor of TC or two factors of TC and LDL value.

Dietary high cholesterol level is a high risk factor for Dyslipidemia and it is statically proven by the research. Hence it is recommended to further research by giving

validated food frequency questionnaire to clearly identify the food which causes Dyslipidemia in SLAF aircrew.
Research statistics indicate that stress levels of Pilots are high, thus it is recommended to further research on stress level of the pilots as it is an aviation safety issue. Further to identify the level of eustress and to maintain that level to get maximum output.

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