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PREDICTION OF FUTURE RISK OF CORONARY ARTERY DISEASE AMONGST FIRE-FIGHTER PERSONNEL OF MUMBAI

Physiotherapy

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ABSTRACT

National commission of macroeconomics and health reported 62 million people in India will have Coronary Artery Disease (CAD) by 2030, with 23 million of these below 40 years of age. Burden of CAD in India can be explained by the alarming rise in prevalence of coronary risk factors like diabetes, hypertension, stress, atherogenic dyslipidemia, smoking, obesity and physical inactivity. Fire fighting personnel are impacted by mental exhaustion, lack of medical attention during fire, 24 hour shifts, interrupted sleep and lack of regular meals. **Study Objective:** To predict future risk of Coronary Artery Disease amonsgt Fire-fighters of Mumbai using ACSM risk factor stratification scoring and IPAQ categories. **Methodology:** The study was carried out after the approval from Institutional Research Review Committee. Participants were interviewed with validated questionnaire (ACSM Stratification Scoring) and relevant information was filled by researcher based on answers given by respondents and their investigation reports of serum cholesterol and fasting plasma glucose levels. Participant's level of perceived stress was measured by Cohen Perceived stress scale. Participants were also asked to fill IPAQ (International Physical Activity Questionnaire – short form). The details obtained from above questionnaires were entered in excel sheet. Bar graphs and pie charts were obtained. Correlation between ACSM categories and IPAQ was carried out using SPSS (16.0). **Result:** Commonest risk factor for CAD being Age (83.47%), Hypertension (65.21%) and Pre-diabetic levels (52.17%). Spearman's correlation (rho) for ACSM categories and IPAQ revealed moderately negative correlation (r = - 0.558) (p=0.000). **Conclusion:** Study provided insight into the circumstances for prediction of CAD risk factors in fire-fighters from South Mumbai. Study findings indicate prevalence of CAD risk factors in fire-fighting officers was 81.72%. Physical inactivity was moderately correlated with ACSM risk factor categories.

KEYWORDS

ACSM, IPAQ, CAD, Risk Factors, Fire-fighters.

INTRODUCTION

Non-communicable diseases (NCD's) continues to be an important public health problem in India. Industrialization, socioeconomic development, urbanization, changing age structure and lifestyles has placed India at a position of growing burden of NCD's.[1] In 2008, NCD's accounted for 5.2 million deaths in India. A rising trend in the burden of NCD's is expected in the years ahead.[2] The burgeoning burden of cad in India can be explained by the alarming rise in the prevalence of coronary risk factors like diabetes, hypertension, stress, atherogenic dyslipidemia, smoking, obesity and physical inactivity.[3] In CVD's, Chronic Artery Disease is the leading cause of death in India, and its contribution to mortality is rising the number of deaths. According to reports from the national commission of macroeconomics and health 62 million people in India will have CAD by 2030, with 23 million of these below 40 years of age.[4] The most stressful jobs in India are that of Policemen, Fire fighters and Ambulance dispatchers. Fire fighting personnel are impacted by mental exhaustion, a lack of medical attention during a fire, driving at high speed, 24-hr shifts, interrupted sleep, lack of regular meals and away from home. As a result, fire fighting personnel are at risk of experiencing psychological stress because of the demands of their professional settings.[7] Fire fighters are exposed to dangerous environments, emergency situations and irregular working hours due to nature of their work. They not only have to extinguish a fire, but also need to do other works such as rescue of a life in disaster situation, emergency medical services and administrative tasks.[5]Numerous occupational factors could precipitate CAD events in fire fighters. First, fire fighting includes long sedentary stretches followed by irregular heavy exertion.Firefighters react immediately to alarms with significant increases in pulse rate. During fire suppression,they work at near maximal heart rates while wearing heavy protective equipment, sometimes for prolonged periods.Heat stress and fluid losses can result in decreases in cardiac output despite sustained tachycardia. Second, self-contained breathing apparatus use has reduced, but not eliminated chemical exposures including carbon monoxide, particulates and other intoxicants. Third, fire fighters experience intermittent noise exposure, which may increase blood pressure. Fourth, firefighters often perform shift work, which may increase the risk of CHD. Personal factors may also increase firefighters' susceptibility to CAD. Amongst them are smoking, alcohol intake, family history, diabetes, hypertension, overweight, obesity, hypercholesterolemia etc. [6]

METHODS AND MATERIAL

Study Design:

This was a cross sectional study following a purposive sampling involving a population of 115 fire-fighters of Mumbai. The inclusion criteria adopted was male fire-fighters from Byculla Fire Station, Mumbai in the age group 25-58 years, excluding the fire-fighters with less than one year experience, known case of CAD or have undergone PTCA or any cardiac surgeries and recent musculoskeletal injuries.

METHODOLOGY:

Informed consent was taken from all the subjects. Demographic history of each subject was taken which included personal, designation and work schedule details. Physical examination of all subjects consists of measuring of height in meters, weight in kilograms and Body mass index was derived by Quetelet's index - weight (kg)/ height (m^2). Blood pressure was measured on two occasions on the same day.[7] The subjects were then interviewed with the already validated questionnaire (*ACSM RISK FACTOR STRATIFICATION SCORING*). The questionnaire was filled based on the answers given by respondents and their investigation reports of serum cholesterol and fasting plasma glucose level were noted. Subjects were then interviewed for *IPAQ* (short-form) and perceived stress scale.Adequate time and privacy was given to answer each question.

1) ACSM (American College of Sports Medicine) Risk Factor Stratification – A questionnaire used to find the risk factors present in participants to determine their current level of cardiovascular disease risk.
2) International Physical Activity Questionnaire (short form)- A questionnaire used to find out about the kinds of physical activities that a person has done in the last 7days as part of everyday life. The results were calculated as per protocol and interpreted as Low, Moderate and High physical activity.
3) Cohen Perceived Stress Scale – Questionnaire that is used to find out perceived stress levels in an individual in the past one month.The answers reported were scored as Very often (4), Fairly often(3), Sometimes(2), Almost never(1), Never(0).

Statistical Analysis

Data was recorded and analyzed using Statistical package for the Social Science software (SPSS version 16).The Shapiro-wilk normality test was used to determine normality of quantitative data which revealed that the data was not normally distributed. Spearman's test was used for the data analysis in software.

RESULT:-

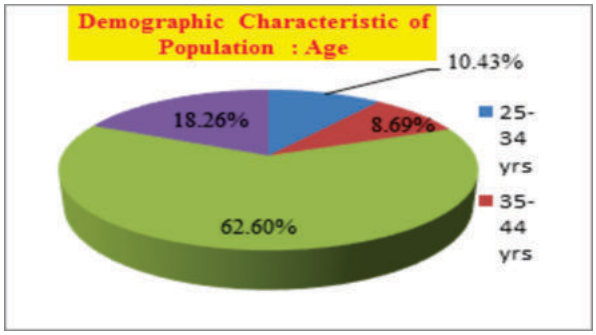


Figure 1: Demographic characteristic of study population.

Inference: Majority (62.60%) of the study population were in the age group 45-54 years followed by 18.26% in the age group above 55 years.

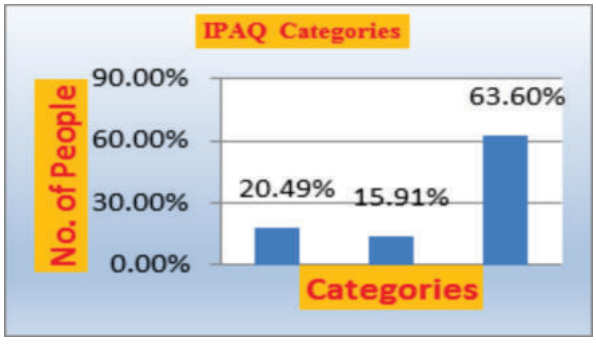


Figure 2: IPAQ Categories

Inference: As per IPAQ category, 72 fire-fighters (63.60%) were moderately active, 30 fire-fighters (20.49%) were minimally active and 13 fire-fighters(15.91%) were highly active. This infers majority of fire-fighters were moderately active

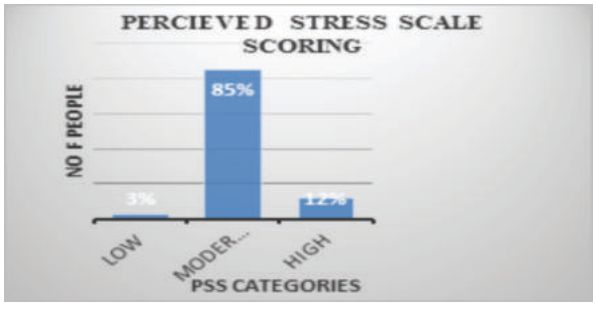


Figure 3: Perceived Stress Scale Scoring

Inference: As per perceived stress scale scoring 7(3%) fire-fighters were low stressed, 90 (85%) fire-fighter were moderately stressed,18 (12%) fire-fighter were highly stressed.

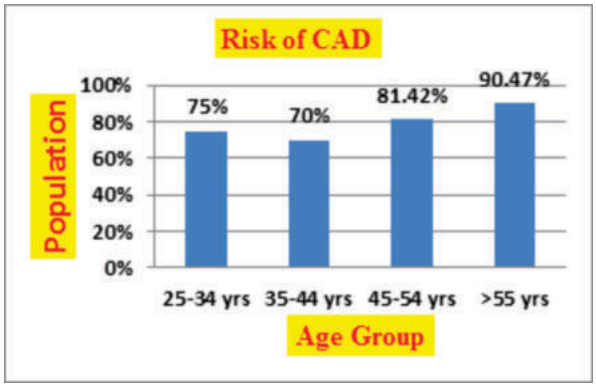


Figure 4: The Risk of CAD in the study population.

Inference: Risk of CAD is highest(90.47%) in age group above 55 years followed by 81.42% in the age group 45-54 years.

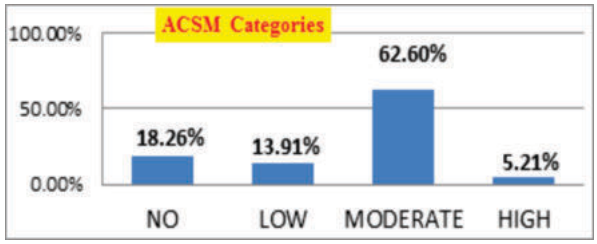


Figure 5: ACSM risk factor stratification scoring categories

Inference:
It was observed that 21fire-fighters (18.26%) had No risk, 16 fire-fighters (13.91%) had Low risk, 72 fire-fighters (62.60%) had Moderate risk and 6 fire-fighters (5.21%) had High risk of developing CAD.

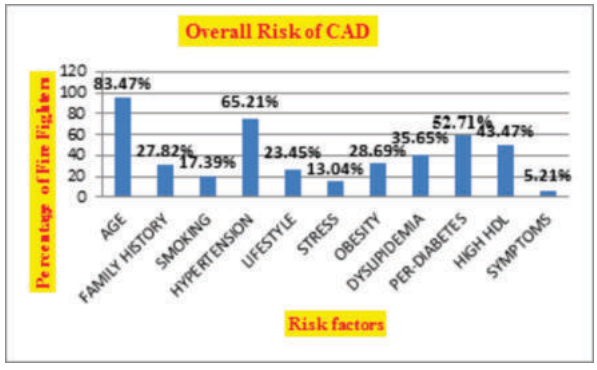
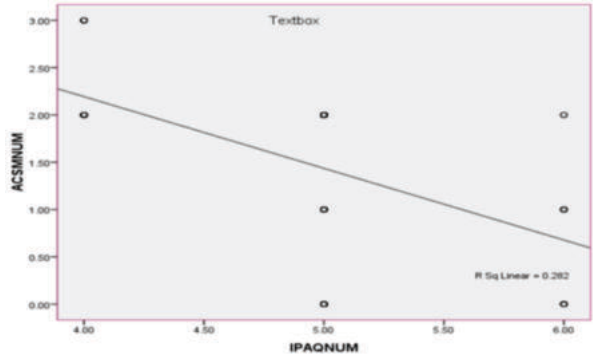


Figure 6: ACSM Risk Factor Distribution

Inference:
ACSM risk stratification scoring (83.47%) increasing age was a majority risk factor, (65.21%) had hypertension followed by (52.71%) pre-diabetes, (43.47%) High HDL and (35.65%) dyslipidemia.



Graph 1: Correlation between ASCM categories and IPAQ.

Inference:
A per Spearman's correlation there is a moderately negative correlation between ACSM Risk Stratification scoring and IPAQ Categories (r= -0.558, p=0.00).

DISCUSSION

The present study consisted of 115 fire-fighters. This study investigated prediction of future risk of Coronary Artery Disease (CAD) amongst fire-fighters of Mumbai. As per the study done by Mohd. Rasheeduddin Imran and B.Syamala devi(2013) it was observed that high work stress has repeatedly been associated with increased risk for cardiovascular disease.[1]

In this study, ACSM risk stratification scoring was used to evaluate future risk of CAD amongst fire-fighters of Mumbai. According to ACSM risk stratification scoring; majority of the study population (83.47%) had increasing age as the major risk factor. With increased age, the arterial wall becomes thicker, stiffer and less flexible due to changes in the connective tissues which includes disorganization and degeneration of elastin and collagen, increased calcification and cross-link collagen and reduction in elastin.[8,9] Hypertension: 65.21% of the total study population has hypertension as a risk factor. Occupational

factors that contributes to blood pressure elevation includes irregular physical exertions,unhealthy diet, work shifts,noise exposure, post-traumatic stress disorder,high job demand and low decisional control. It has a shearing effect on epithelial lining of arteries thereby leading to increased proliferation of smooth muscles in arterial wall and thus causing arterial occlusion by plaque formation. Long standing hypertension → elevation in after-load → hypertrophy → Left ventricular failure. [10]Prediabetes: 52.71% of the total study population had pre-diabetes as a risk factor mainly due to family history, genetic predisposition, physical inactivity and stress. Hyperglycemia,elevated free fatty acid,increased amount of circulating end glycosylated serum products and insulin resistance are the main mechanisms involved in accelerating atherosclerotic process.[10]High HDL: 43.47% of the total study population had high HDL level. It helps in reverse cholesterol transport system thus serving as a chemical shuttle that transports excess cholesterol from peripheral tissues to the liver. Therefore, it is positively associated with a decreased risk of CAD. Dyslipidemia: 35.65% of the total study population had dyslipidemia as a risk factor due to low physical activity and more fast food consumption. LDL and HDL are responsible for transport of endogenous cholesterol. LDL transports cholesterol to the body cells while HDL transports cholesterol from body`s cholesterol pools to liver for excretion. Thus, low HDL and high LDL are equally atherogenic. Arteries respond by smooth muscle cell proliferation, increased collagen formation and inflammatory reactions leading to increased risk of CAD.

Obesity: 28.69% of the total study population had obesity as a risk factor due to prolonged sitting physical inactivity. Obesity is strongly related to hypertension, diabetes, dyslipidaemia and physical inactivity. Lack of exercise leads to reduced insulin sensitivity, reduces glucose tolerance, reduces HDL cholesterol level, increases triglyceride and LDL cholesterol level. It even impairs fibrinolysis, endothelial cell function and elevates homocysteine level thereby damaging arterial endothelium and inhibiting anticoagulant cascade. Family History: 27.82% of the total study population had family history as a risk factor. Familial predisposition to CAD was related to other risk factors like diabetes, hypertension and hypolipo proteinaemia. Stress: 13.40% of the total study population had stress as a risk factor. It causes an increase in the production and circulating levels of catecholamines (β-adrenergic stimulators) thereby increasing blood pressure and myocardial oxygen demand and may cause damage to endothelial cells of arterial blood vessels and platelet agglutination.

Smoking: 17.39% of the total study population had smoking as a risk factor. Carbon mono-oxide binds with haemoglobin in blood that produces carboxyl-haemoglobin which damage the endothelial cells of the arteries which increases the permeability of the arteries to the invasion of lipids. Nicotine is a potent vasoconstrictor. Smoking also results in elevated fibrinogen level thereby leading to platelet aggregation and thrombus formation. . Certain earlier studies suggested that some conventional risk factors, such as smoking and hypercholesterolemia were more prevalent among professional drivers and accounted for their increased risk for CAD.[1] Stress: 13.04% of the total study population had stress as a risk factor. Firefighting personnel are exposed to stressful situations and traumatic incidents. After involvement in a disaster or a traumatic incident, firefighting personnel may be at risk for acute stress disorder leading to post-traumatic stress disorder causing depression, anxiety, loss of appetite,lack of sleep, fear and constant worry.[7]Mental stress can activate the sympathetic-adrenal-medullary(SAM)axis, eliciting the release of catecholamines (NE and EPI) resulting in elevation of heart rate and blood pressure and may partially contribute to elevated risk of CAD.[15]

Physical activity was assessed using IPAQ questionnaire. As per IPAQ category, 72 fire-fighters (63.60%) were moderately active, 30 fire-fighters (20.49%) were minimally active and 13 fire-fighters(15.91%) were highly active. This infers majority of fire-fighters were moderately active. This indicates majority of fire-fighters were moderately active because of their sedentary lifestyle, prolonged sitting and long working hours.

ACSM scores was found to be moderately correlated to IPAQ scores (negative correlation) which clearly indicates that higher the score of ACSM, lower is the physical activity. Thus the result provides an insight about how the exercise (physical activity) could be considered in managing these risk factors.

Study also showed strong negative correlation between ACSM categories and IPAQ which indicates lower the physical activity, higher the ACSM risk factor. physical activity helps to prevent the development of diabetes, helps maintain weight loss, and reduce hypertension, which are all independent risk factor for CAD therefore low physical activity leads to de-conditioning effect on the cardio-respiratory system resulting in higher ACSM risk factors. Based on our findings, we recommend that fire-fighters health be better monitored for risk factors of cardiovascular disease. Thus the result provides an insight about how the exercise (physical activity) could be considered in managing these risk factors.

CONCLUSION

The present study showed moderately high prevalence (80%) of CAD risk factors amongst fire-fighters of Mumbai. It was observed that fire-fighters were exposed to volley of problems in all three domains of health viz. physical, mental & social, owing to their unique job profile. Hypertension, age and pre-diabetes were found to be the commonest risk factors amongst the study population followed by obesity, dyslipidemia, smoking and stress. This study suggests that the excess risk of CAD in fire-fighters may well be prevented by manipulation of parameters viz., working hours, shift duty, physical activity, smoking habits and to work with improved planning preventing stress.

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