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THE RISK ASSESSMENT OF CARDIOVASCULAR DISEASE DEVELOPMENT AMONG HEALTHCARE PROFESSIONALS BY USING FRAMINGHAM AND ATHEROGENIC INDEX OF PLASMA RISK SCORES

Pharmaceutical Science

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ABSTRACT

Cardiovascular disease (CVD) is a leading cause of morbidity and mortality worldwide, with healthcare professionals potentially at elevated risk due to occupational stress and lifestyle factors. This study aims to assess the ten-year risk of developing cardiovascular disease (CVD) among healthcare professionals using the Framingham Risk Score (FRS) and Atherogenic Index of Plasma (AIP). **Study Design:** A prospective observational study. **Study Period:** Duration of 6 Months. **Study Site:** healthcare centers in Sanga Reddy region. **Methodology:** The study was conducted among healthcare professionals in the Ranga Reddy region. Cardiovascular disease (CVD) risk was assessed using the Framingham Risk Score (FRS) and the Atherogenic Index of Plasma (AIP), categorizing participants into low, moderate, and high-risk groups. The predictive accuracy of FRS and AIP for CVD risk was evaluated using biostatistical analysis. **Results:** The Framingham Risk Score (FRS) classified 84.8% of participants as low risk, 12.9% as moderate risk, and 2.2% as high risk. The Atherogenic Index of Plasma (AIP) categorized 81.9% as low risk, 15.2% as moderate risk, and 2.9% as high risk. The prevalence of CVD risk was similar for both methods: 0.8 for low risk, 0.12 (FRS) and 0.15 (AIP) for moderate risk, and 0.02 for high risk. The difference in prevalence between FRS and AIP was not statistically significant ($p > 0.05$), indicating that both methods can be effectively used for assessing the 10-year CVD risk among healthcare professionals. **Conclusion:** This study provides baseline data on the 10-year CVD risk among healthcare professionals in the Ranga Reddy region, with most categorized as low risk by both the Framingham Risk Score (FRS) and Atherogenic Index of Plasma (AIP). The findings show no significant difference between FRS and AIP in risk prediction ($p > 0.05$), supporting their use for CVD assessment. Regular health check-ups and stress management are essential to mitigate potential risks, and further research should examine the long-term effects of occupational stress on cardiovascular health.

KEYWORDS

Cardiovascular Disease, Healthcare Professionals, Framingham Risk Score, Atherogenic Index of Plasma, Risk Assessment, Occupational Stress, Lipid Profile, Prevalence

I. INTRODUCTION

Cardiovascular Diseases:

CVD covers a wide array of disorders, including diseases of the cardiac muscle and of the vascular system supplying the heart, brain, and other vital organs.

Predominant Cardiovascular Diseases:

- Ischemic heart disease (IHD).
- Stroke.
- Congestive heart failure (CHF).

Ischemic Heart Disease: The two leading manifestations of IHD are angina and acute myocardial infarction. Angina is the characteristic pain of IHD. It is caused by atherosclerosis leading to stenosis (partial occlusion) of one or more coronary arteries.

Acute myocardial infarction (AMI) is the total occlusion of a major coronary artery with a complete lack of oxygen and nutrients leading to cardiac muscle necrosis. AMI is usually diagnosed by changes in the electrocardiogram; by elevated serum enzymes, such as creatine phosphokinase and troponin T or I; and by pain similar to that of angina[1-4].

Stroke:

Stroke is caused by a disruption in the flow of blood to part of the brain either because of the occlusion of a blood vessel (ischemic stroke) or the rupture of a blood vessel (hemorrhagic stroke). Many of the same risk factors for IHD apply to stroke; in addition, atrial fibrillation is an important risk factor for stroke.

Congestive Heart Failure: CHF is the end stage of many heart diseases. It is characterized by abnormalities in myocardial function and neurohormonal regulation resulting in fatigue, fluid retention, and reduced longevity. CHF is caused by pathological processes that affect the heart; IHD and hypertension-related heart disease are the most common etiologies.

Smoking

Until 2016, after China, India was the second largest consumer of tobacco. However, as per the report of Global Adult Tobacco Survey-2 in June 2017, there was a 6% decline in the prevalence of tobacco use among adults (>15 years) in India[8].

The smoking rates among men were constantly on decline since 1995–1996 till 2016–2017 and among women from 2.9% to 2% for the corresponding period[9].

Framingham Heart Study:

The Framingham heart study was undertaken by United States Public Health Service in order to investigate possible factors, both biological and environmental, that might explain the epidemic of cardiovascular disease observed in United States during 1930 The Framingham heart study also established the role of blood pressure in the development of CVD, and dispelled the myths that blood pressure may be less harmful in worsen and that the elderly may tolerate higher blood pressures. Smoking was also found to be associated with increased risk of myocardial infarction (M) in the Framingham population, and the risk increased with the number of cigarettes smoked. The fect tant filters in cigarettes gave no protection for CHV was also another finding. The Framingham Heart study is an ongoing study recruiting the children (Framingham off spring study) and grandchildren (Third generation study) of the original cohort.

Importance of Framingham Heart Study:

It identifies the common factors or characteristics that contribute to CVD by following its development over a long period of time in a large group of participants who had not yet developed over the symptoms of CVD or suffered a heart attack or stroke.

Framingham Risk Score (FRS):

The Framingham risk score is a simplified and common tool for the assessment of risk level of CVD over 10 years. The FRS considers six coronary risk factors, including: AGE, Gender, Total, Total cholesterol (TC), High density lipoprotein cholesterol (HDL), Smoking habits, Systolic blood pressure.FRS is the most applicable method for predicting the person's chance of developing CVD in long term. The cutoff's for calculating FRS were as follows:

TC<160, 160-199, 200-239, 240-279 and ≥280 mg/dl

Systolic blood pressure: <120, 120-129, 130-139, 140-159 and ≥160mmlig
HDL-C<40, 40-49, 50-59 and 260mg/dl.

Importance of FRS:
FRS gives an indication of the likely benefits of prevention, they are useful for both the individual patient and for the clinician in helping to decide whether lifestyle modification, education and preventive medical treatment are needed to the patient[5-6].

Atherogenic Index of Plasma (AIP) Risk Scores:
The atherogenic index of plasma (AIP), calculated as a logarithmically converted ratio of TG to HDL-C, has been used to identify atherogenic dyslipidemia and insulin resistance based on a positive association with cholesterol esterification rates, lipoprotein particle size, and remnant lipoproteinemia[7-8].

It has been suggested that an AIP value of under 0.11 is associated with low risk of CVD; the values between 0.11 to 0.21 and upper than 0.21 are associated with intermediate and increased risks, respectively .

II. AIM & OBJECTIVES

Aim
The Aim of The Study is to Assess The risk of Cardiovascular Disease Development Among Healthcare Professionals Over the Next Ten Years by Using Framingham and Atherogenic Index of Plasma Risk Scores.

Objectives
- Identify the primary risk factors contributing to cardiovascular disease (CVD) among health care professionals.
- Utilize the Framingham Risk Score (FRS) and Atherogenic Index of Plasma (AIP) to calculate individual CVD risk scores for health care professionals.
- Compare the predictive accuracy of the Framingham Risk Score and the Atherogenic Index of Plasma in assessing the risk of CVD development.

III. MATERIALS AND METHODS

Study Design: A prospective observational Study.
Study Site: Healthcare centres in Sanga Reddy region
Sample Size: 316
Study Period: 6 months
Preparation of Questionnaire: The questionnaire was prepared according to required parameters.

Selection of Study Subjects:
Inclusion Criteria:
1. Healthcare Professionals
2. 25-65 years age group.

Exclusion Criteria:
1. Healthcare Professionals with history of CVD
2. Pregnant women and lactating mothers

Materials
In this study the following materials were used. They are:
1. Informed consent forms
2. Questionnaire forms (physical / Google forms)

Scores Used:
1. Framingham risk score
2. Atherogenic index of plasma risk score

IV. METHODOLOGY

This is a prospective observational study conducted through Questionnaire forms circulated physically and some subjects via online mode through google forms. The study protocol was prepared and all the aspects of the study protocol including access to patient information was presented to the Institutional ethics committee for approval. Sanga Reddy healthcare professionals were included for the study and sample size was calculated by using Chron's Formula. (n= 316).

Informed Consent and questionnaire forms were distributed physically and through online mode depending on the availability of the subject. Collected data was analysed and assessed percentage of risk using Framingham Risk Score & Atherogenic index of plasma risk score. Accuracy of the result was checked by comparing the results obtained by both Risk score methods by applying biostatistical tools.

Obtaining Clearance from Institutional Ethical Committee:
For obtaining the ethical clearance, an application along with study protocol, which included the proposed title, study site, inclusion and exclusion criteria, objective and methodology about work to be carried out was submitted to chairman of the institutional ethical committee of MNR Institutions.

Collection of Data:
Data was collected by circulating patient-oriented questionnaire, google forms and consent forms to the selected sample.

Analysis of Data:
- The required details from the study subjects were collected, paying due attention to inclusion and exclusion criteria. Analysis of data was done to compare the predictive accuracy of the Framingham Risk Score and the Atherogenic Index of Plasma.
- The comparison of the results obtained by FRS and AIP was done by using Student's t Test. The prevalence of the disease was calculated by using formula;

Prevalence = No of participants at risk/ Total number of participants

The prevalence compared by using student's t test.

Interpretation of Data:
- By using biostatistical reports data was analysed and comparisons of the Framingham and AIP risk scores predictor for CVD risk among Health care Professionals.
- Identification of any correlations or discrepancies between the two-scoring system was done.

Sample Distribution
The obtained sample size was 316 which was calculated by using chrons formula, The participants are distributed in the population and analysed based upon their age, gender, occupation, smoking status, physical activity, blood pressure, total cholesterol, HDL cholesterol and Triglycerides.

Age Wise Distribution of Participants:
The details of the participants according to their age is given in Table 4.1 and in Figure 4.1

Table 4.1: Age Wise Distribution of Participants

Age group (in Years)	Number of participants
25-34	120 (38%)
35-44	71 (23%)
45-54	70 (22%)
55-60	55(17%)

In the current study of risk assessment of CVD in healthcare professionals, the participants were of different age group. In this 38% (120 individuals) were aged 25-34, 23% (71 individuals) were aged 35-44, 22% (70 individuals) were aged 45-54, and 17% (55 individuals) were aged 55-65. The Average age of the participants is 40.99 ± 11.88 years. About 61% participants are young which is a reflection of working population.

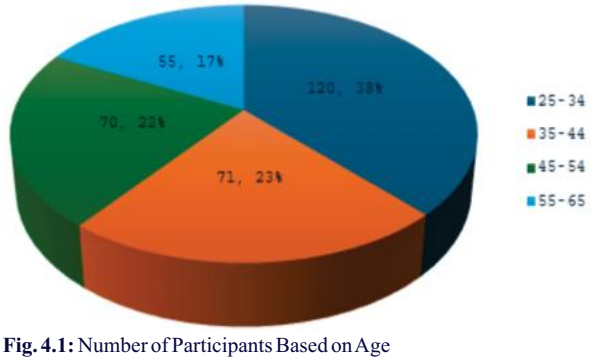


Fig. 4.1: Number of Participants Based on Age

Age Wise Distribution of the Risk Among Individual Based on FRS
Table 4.2: Age wise distribution of the risk among individuals based on FRS.
Table 4.2: Risk Score Distribution According To Gender Based On FRS

Gender	Low	Moderate	High
Male	118 (75.15%)	32 (20.38%)	7 (4.5 %)
Female	148 (93.08%)	11 (6.9%)	0

Table 4.3 Age and Cholesterol Percentage

The data in Table 4.2 reveals that based on the FRS, the majority of individuals in the 25-34 age group falls into the low-risk category (97.5%), whereas the 55-65 age group shows a more distribution across low (43.63%), moderate (43.63%), and high-risk (12.72%) categories, suggesting that risk levels increase with age.

4.4. Gender Wise Distribution of Participants:

Table.4.4 Distribution of Participants Based on Gender

Male	Female
157 (49.68%)	159 (50.31%)

In the gender wise distribution of participants 49.68% of the participants were male (157 individuals) and 50.31% were female (159 individuals) were participated, providing a balanced gender representation.

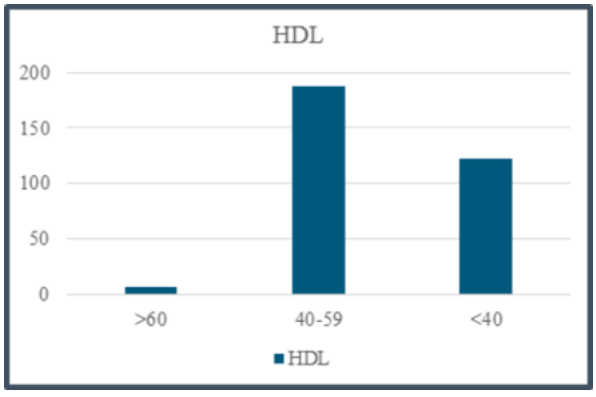
4.5. HDL Cholesterol in the Individuals Participated in the Study:

The HDL cholesterol levels in the participants is given in the Table. 4.5 and Figure.4.5

Table. 4.5: Distribution of participants based on HDL cholesterol

HDL Cholesterol values	Number of Individuals
>60	7
40-59	187
<40	122

Among the 316 participants, 7 persons were in the healthy range of HDL cholesterol (>60mg/dl), 187 persons were in the range of 40-59mg/dl, 122 persons were in the range of below 40 which is at risk.



4.6 FRS Risk Chart Distribution of HDL-Cholestero

Table 4.6. HDL Cholesterol in the Individuals Participated in the Study:

HDL cholesterol	Low	Moderate	High
>60	3(42.85%)	3 (42.85%)	1(14.21%)
40-59	166(88.77%)	18(9.62%)	3(1.60%)
<40	99(81.14%)	20(16.39%)	3(4.45%)

The data suggests that, majority of participants with HDL cholesterol levels in the 40-59 mg/dL range are at low risk (88.77%), while those with HDL levels below 40 mg/dL have a higher percentage in the high-risk category (4.45%). This suggests that lower HDL cholesterol levels are linked to an increased risk of cardiovascular disease (CVD).

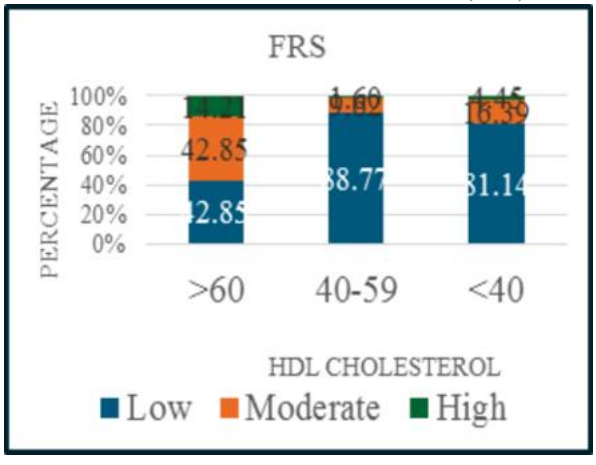


Table 4.7. HDL Cholesterol in the Individuals Participated in the Study:

HDL cholesterol	Low	Moderate	High
>60	2(28.57%)	3(42.85%)	2(28.57%)
40-59	162(86.63%)	22(11.76%)	3(1.60%)
<40	95(77.86%)	23(18.85%)	4(3.27%)

The data suggests that, majority of participants with HDL cholesterol levels in the 40-59 mg/dL range are at low risk (86.63%), while those with HDL levels below 40 mg/dL have a higher percentage in the high-risk category (3.27%). This suggests that lower HDL cholesterol levels are linked to an increased risk of cardiovascular disease (CVD).

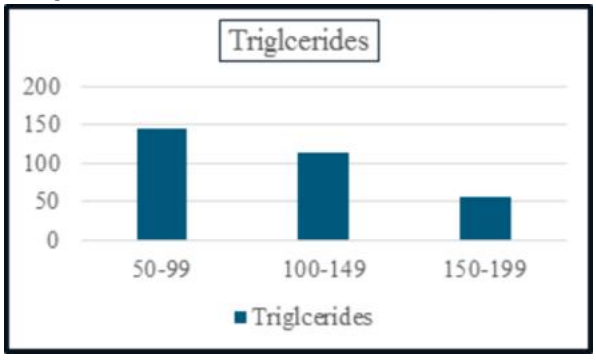
4.8. Triglycerides in the Individuals Participated in the Study:

Triglyceride levels in the participants given in the Table. 4.8 and Figure. 4.8

Table.4.8 Distribution of Participants Based on Triglycerides

Triglycerides (mg/dl)	Number of Individuals
50-99	144
100-149	115
150-199	57

A total of 144 persons triglycerides were in the range of 50-99mg/dl, 115 were in the range of 100-149mg/dl, 57 were in the range of 150-199mg/dl



4.9 AIP Risk Chart of Triglycerides:

Table.4.9 Risk Distribution of Participants Based on Triglycerides

Triglycerides	Low	Moderate	High
50-99	134(93.05%)	8(5.55%)	2(1.38%)
100-149	99(86.08%)	13(11.30%)	3(2.60%)
150-199	26(45.61%)	27(47.36%)	4(7.01%)

According to AIP, the risk status of participants calculated and shown in table 4.2 and figure 4.2. The majority of participants with triglyceride levels in the 50-99 mg/dL range are at low risk (93.05%), while those with levels in the 150-199 mg/dL range have a higher percentage in the high-risk category (7.01%). This indicates that higher triglyceride levels are associated with increased cardiovascular disease (CVD) risk.

5.0 FRS Risk:

Cardiovascular disease (CVD) risk over the next 10 years in percent was calculated with the help of the Framingham Risk Score. Individuals with low risk were 10% or less CVD risk at 10 years, with intermediate risk 10-20%, and with high risk 20% or more.

Table. 5.0: Number of Participants Under Framingham Risk

FRS risk	Number of participants
Low	268 (85%)
Moderate	41 (13%)
High	7 (2%)

In the CVD risk assessment using Framingham risk score (FRS) 268 individuals were having low risk of CVD in the coming ten years, 41individuals have moderate risk and 7 individuals are at high risk.

5.1 Comparison of FRS and AIP Risk Scores:

Comparing the FRS and AIP scores among participants are given in the Table. 4.1 and Figure. 4.1

Table. 5.2: Comparison of FRS and AIP

Risk scores	FRS Risk	AIP Risk
Low	268	259

Moderate	41	48
high	7	9

In comparing the FRS and AIP risk scores among the study population, FRS classified 268 individuals as low risk, 41 as moderate risk, and 7 as high risk, whil

Risk	FRS	AIP
Low	0.8	0.8
Moderate	0.12	0.15
High	0.02	0.02

Prevalence of Disease Among Healthcare Professionals

- The prevalence of the CVD was calculated by using Time prevalence formula. The scores used FRS AND AIP showed the similar type of prevalence which is statically not significant when compared.
- The FRS and AIP, both the test tests showed the low-risk category prevalence 0.8 while moderate risk category is 0.12 and 0.15 respectively. The difference in the risk score obtained by both the test is not significant (P 0.05). The high-risk scores calculated by both the test FRS and AIP and the prevalence obtained is 0.02 by both the method.
- The overall results of prevalence suggests that there is no statistical difference when used FRS and AIP, which helps to conclude that any method either FRS and AIP can be used to assess CVD risk over the next 10 years.

VI. CONCLUSION

The prevalence 10-year risk of developing cardiovascular disease (CVD) among health Care professionals using Framingham and Atherogenic Index of plasma risk scores was low in majority of the respondents probably because of their access to information regarding cardiovascular health. This study is offering a base line data on the estimation of cardiovascular risk among health Care professionals in Sangareddy region.The results showed that approximately 85% of participants were categorized as low risk based on FRS, and 82% based on AIP. Although most healthcare professionals were found to be at low risk, the high-stress nature of their jobs and demanding schedules might elevate their risk over time. Therefore, regular monitoring and comprehensive risk assessments are essential to prevent potential CVD issues. Our findings highlight the importance of regular health check-ups and stress management programs for healthcare professionals to maintain their cardiovascular health. Continuous monitoring can help in early detection and intervention, preventing future complications. More studies are needed to explore the long-term effects of stress and workload on cardiovascular health among healthcare professionals. The insights from this study can guide the development of tailored health programs and interventions, ensure the well-being of healthcare professionals and enhance their ability to provide quality care to patients. The difference between the two tests FRS and AIP is not statistically significant ($p > 0.05$) which suggests the compatibility of the both the tests in assessment if cardiovascular diseases.

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