Comparative Study of Selected Biochemical Parameters between Middle-Aged Farmers and Non-Farmers of Murshidabad District in West Bengal, India

Mursalim Shaikh* and Dr. Kishore Mukhopadhyay**

*Research Scholar,
Dr. C.V. Raman University,
Kargi Road, Kota, Bilaspur, C.G.

**Associate Professor,
Union Christian Training College,
Berhampore, Murshidabad, W.B.

Abstract:

Farmers are playing a major role by producing food and crops for the nation. The majority of the population of India is villagers. There is a tremendous progression of CVD among village farmers in India and one of the important causes behind it is dyslipidemia or hypercholesterolemia. The present status study aimed to analyze the difference in selected biochemical parameters between male village farmers and non-farmers age groups between 45 to 55 years. Cholesterol and low-density lipoprotein were significantly higher in case the of farmers than non-farmers whereas, other lipid markers were unchanged. Proper medical interventions along with stress management, physical exercise, nutritional upliftment, and health literacy are highly recommended for the villagers especially farmers.

Keywords: Farmers, Non-farmers, CVD, Cholesterol, Triglycerides, LDL, HDL and LDL.

Introduction:

In the past ten years, there has been a significant increase in the prevalence of diabetes and its related cardiovascular problems, primarily in middle- and lower-income nations. In these nations, the majority of the sufferers reside in rural areas. (1) In recent years, cardiovascular disease has seen a sharp increase in prevalence in India and other emerging nations (CVD). Cardiovascular disease (CVD) had overtaken all other causes of death in India at the turn of the century. (2) When compared to those of European descent, Indians get CVD at least ten years earlier and at the prime of their most productive middle age. (3)

Significant advancements were made in social development, health, nutrition, and life expectancy throughout the second half of the 20th century. As a result, the number of deaths from communicable diseases has decreased, while the number of deaths from non-communicable diseases has increased. This has been related to changes in nutrition, epidemiology, and demography such as population ageing and the transition from communicable to non-communicable diseases) (e.g high caloric intake and low levels of physical activity). Therefore, NCDs are currently responsible for 53% of total death and 44% of lost disability-adjusted life years (DALYs). By 2030, projection indicates that CVD is the main cause of death with 52% of all deaths from NCDs related and 29% of total deaths. (4-5)

One of the main causes of death for rural farmers is heart disease. Heart disease is an umbrella term used to describe all diseases related to heart. Heart disease includes arrhythmias, heart failure with preserved ejection fraction (HFpEF), heart failure with reduced ejection fraction (HFrEF), and coronary heart disease (CAD). (8) In addition, ischemia causes the death of cardiac tissue, resulting in a heart attack, commonly known as a myocardial infarction (MI). (9) A coronary artery thrombus in an area of prior damage might result in MI, which can be a direct result of heart disease in 80–90% of cases. (9). Heart disease can directly result in MI, which is 80–90% brought on by a coronary artery thrombus in an area of prior injury. (9). Heart disease is connected with a variety of both modifiable and unmodifiable risk factors, and these risk variables can aid in determining the likelihood of long-term consequences from heart disease. (8–9) Compared to other populations, farmers are more likely to develop heart disease. (7-8)

Another well-established risk factor linked to a higher incidence of heart attacks is the middle-aged population. Heart attacks are more likely to occur in males over 45 and in women over 55. (10) People over 65 had the highest prevalence of heart disease (19.8%), followed by people in the 45–64 age group (7.1%), and then people in the 18–44 age group (1.2%). (11-12)

The Centers for Disease Control and Prevention (CDC) state that although the prevalence of heart disease is gradually decreasing, it still accounts for one in five deaths. (13–14) It is hoped that decreases in prevalence hopefully not mask persistent disparities in disease based on demographic characteristics and geographic location. (14) The prevalence has changed and is significantly influenced by gender, race, educational attainment, and place of residence. It was shown that males with less education who resided in southern states

were now generally at greater risk. (13-15) Programs should therefore concentrate more on particular states and demographics with higher frequency, such as farmers over 45 living in rural areas.

Middle-aged men and women are particularly prone to atherosclerotic cardiovascular disease (ASCVD), and hyperlipidemia has been identified as a significant risk factor. (17-18)

The cholesterol carried by circulating lipoproteins carrying apolipoprotein (apo) B, specifically low-density lipoprotein cholesterol (non-HDL-C) and low-density lipoprotein, has been examined in a variety of epidemiologic investigations and randomised controlled trials. High levels of cholesterol, or LDL-C, which are the primary causes of atherosclerosis and lower cholesterol have bee accounting for 50% of total mortality and 79% of chronic disease deaths n reported to lower the risk of ASCVD. (17-20)

Dyslipidemia is regularly assessed for cardiovascular risk assessment purposes and it is further notifying that higher serum total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), or triglycerides (TG), and lower serum high-density lipoprotein cholesterol (HDL-C) is significantly related with dyslipidemia (21-23). Although different geographical locations have different rates of dyslipidemia, the condition is thought to affect more than 50% of adults worldwide. (24-26)

In Iran, cardiovascular disease (CVD) is the major cause of death, responsible for 79% of deaths from chronic diseases and 50% of all mortality. (27) Atherosclerosis is a primary contributor to CVD (28). To combat the rising incidence of CVD and its risk factors, such as hypertension (HTN), an unhealthy diet, obesity, and dyslipidemia, public health agencies around the world have concentrated on lowering modifiable CVD risk factors. (23,29-32)

Endothelial dysfunction can result from dyslipidemia, which is brought on by a high-fat, high-calorie diet. (33) Independent CVD risk predictors include serum TG, TC, LDL-C, HDL-C, TC/HDL-C, and LDL-C/HDL-C ratios. Currently, lowering serum LDL-C levels is the major objective of treatment for dyslipidemia. (34) The tunica intima of the artery wall can become coated with elements of the circulating lipid profile, particularly modified LDL-C, which is then engaged in the atherogenic process. In people with familial hypercholesterolemia, the advantages of reducing plasma LDL-C concentrations on CVD risk are more pronounced. (38) Despite the fact that extensive cohort studies have shown a strong correlation between high TG levels and cardiovascular disease (CVD), particularly atherosclerotic CVD, although its status as an

independent risk factor for CVD is still debatable. This is so because greater levels of TG are linked to lower levels of HDL-C and higher levels of atherogenic small dense LDL particles. (38)

Despite the fact that HDL-C has been linked to CVD prevention due in part to its function in reverse cholesterol transport (22,40), some studies have found no correlation between high or normal levels of HDL-C with the prevention of CVD-related events. (41) The ability of HDL to take part in retrograde transport may be diminished by modified versions of several HDL protein components, which are most likely produced by oxidative stress. (41)

The purpose of the study was to compare the effect of cardiovascular risk factors based on the blood lipid profile between farmers and non-farmers of Murshidabad district in West Bengal, India.

Types of Blood Lipids:

The three main types of lipids are phospholipids, sterols, and triacylglycerols (also known as triglycerides).

1.The outer layer of cells in both animal and human bodies is made up of phospholipid. They surround the cells with a barrier which cause issues for those who suffer from the uncommon autoimmune disorder known as antiphospholipid syndrome (APS). APS frequently affects lupus patients, particularly women. (42)

2. A type of steroid are sterols. A class of hormones known as steroids are produced by the body from lipids. the primary sterol found in humans, cholesterol. 20% of the cholesterol in our food and the most of it is created by the liver and the intestines. Every cell in the body has cholesterol, which is involved in many vital bodily processes like the production of hormones and vitamin D. (43) Additionally, cholesterol is essential for the production of bile salts, which the body uses to digest fat and assimilate nutrients. (44)

As a lipid and not a water-soluble substance, cholesterol needs protein to go through the bloodstream. High-density lipoprotein (HDL) and low-density lipoprotein (LDL) are the two most well-known types of proteins that transport cholesterol (LDL). (43) Triglycerides and cholesterol must travel through the plasma with other lipoprotein particles since they are nonpolar lipids that are insoluble in water. The five main classes of plasma lipoproteins—chylomicrons, very-low-density lipoproteins (VLDL), intermediate-density lipoproteins (IDL), low-density lipoproteins (LDL), and high-density lipoproteins—are distinguished by their hydrated density, electrophretic mobility, size, and relative content of cholesterol, triglycerides, and protein (HDL). (45)

3. Triglycerides, the most prevalent lipid type in the human body, are derived from dietary fats and oils. We need triglycerides for energy; hence they are essential.

We can take either saturated or unsaturated lipids in our diet. Saturated fats are primarily sourced from animal products like meat, butter, and cheese and are solid at room temperature. At room temperature, unsaturated fats are typically liquid and are frequently but not always sourced from plants.

Classes of Apolipoproteins

Apolipoproteins can be classified in the following four heads (46)

• Chylomicrons are a dietary fat transporter that is rich in triglycerides.

• Very Low-Density Lipoprotein (VLDL) - A triglyceride-rich transporter of of hepatic synthesized triglycerides (TG)

• Intermediate and Low-Density Lipoprotein (IDL & LDL) - Remaining, cholesterol-rich particles produced when triglycerides in VLDL are lipolyzed

• High Density Lipoprotein (HDL): A lipid-rich particle that carries cholesterol to the liver for recycling.

It is hypothesized that selected biochemical parameters of farmers and non-farmers will differ significantly as both groups are villagers but the nature of physical activities in relation to occupation is different.

$$\mathbf{H}: \quad M_1 \neq M_2$$

Methodology:

15 male farmers and 15 male non-farmers selected randomly for the study from Murshidabad District of West Bengal, India. The age groups of the samples ranged from 45 to 55 years.

Biochemical parameters were measured from 12 hours fasting blood samples following Immunoturbidimetry method (47) and with the help of Erba EM200 (48) Fully Automated Biochemistry Analyzer. The mean age, height weight of the village farmers was 48.36 ± 2.92, 166.46 ± 2.23 and 62.6 ± 4.84 whereas, 51.13 ± 3.26, 165.73 ± 2.43 and 69.66± 5.99 respectively for non-farmers. Table-1 represents the personal profile of the subjects. For statistical purpose t test was calculated with significant level fixed at .05 level of significance.

Table-1. Personal profile of the subject

Group	Age (Years)	Height	Weight (Kgs)
Farmers	48.36 ± 2.92	166.46 ± 2.23	62.6 ± 4.84
Non-Farmers	51.13 ± 3.26	165.73 ± 2.43	69.66± 5.99

Results:

Table-2. Comparison of biochemical parameters between farmers and non-farmers

Cholesterol (mg/dl)					
GROUPS	MEAN	SD	Difference of mean	t-value	p-value
Farmers	220.73	17.37	42	5.07 *	2.28
Non-farmers	178.73	27.29			
Triglycerides (mg/dl)					
GROUPS	MEAN	SD	Difference of mean	t-value	p-value
Farmers	193.33	81.09	25 .40	1.01	0.32
Non-farmers	167.93	52.56			
HDL (mg/dl)					
GROUPS	MEAN	SD	Difference of mean	t-value	p-value
Farmers	42.73	13.83	1.00	0.23	0.82
Non-farmers	43.73	9.62			
LDL (mg/dl)					
GROUPS	MEAN	SD	Difference of mean	t-value	p-value
Farmers	143.13	26.95	43.73	4.50*	0.000110035
Non-farmers	99.4	26.33			
VLDL (mg/dl)					
GROUPS	MEAN	SD	Difference of mean	t-value	p-value
Farmers	38.73	10.94	5.53	1.41	0.17

Non-farmers	33.2	10.50			

*Significant at .05 level of significance

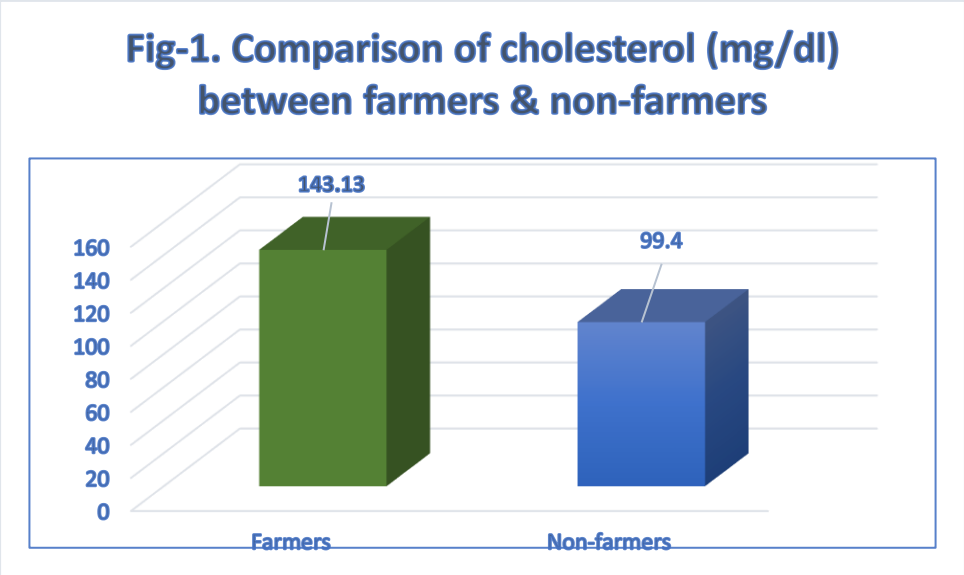
Cholesterol level of farmers and non-farmers were 220.73 ± 17.37 and 178.73 ± 27.29 respectively, which indicates a significant mean difference at .05 level (t value of 5.07 and p value of 2.28). Mean Triglyceride level of farmers and non-farmers were 193.33 ±81.09 and 167.93±52.56, which indicates insignificant difference and High-Density Lipoprotein (HDL) of both the groups were 42.73±13.83 (Farmers) and 43.73±9.62 (non-Farmers) indicates no significant difference, whereas, mean value of Low-Density Lipoprotein (LDL) of farmers and non-farmers were significantly differ at .05 level of significance (t value 4.50). In case of Very Low-Density Lipoprotein (VLDL) the mean difference of farmers and non-farmers were 5.53, which indicates an insignificant calculated t-value (1.41). Table-2, indicates the findings of the study.

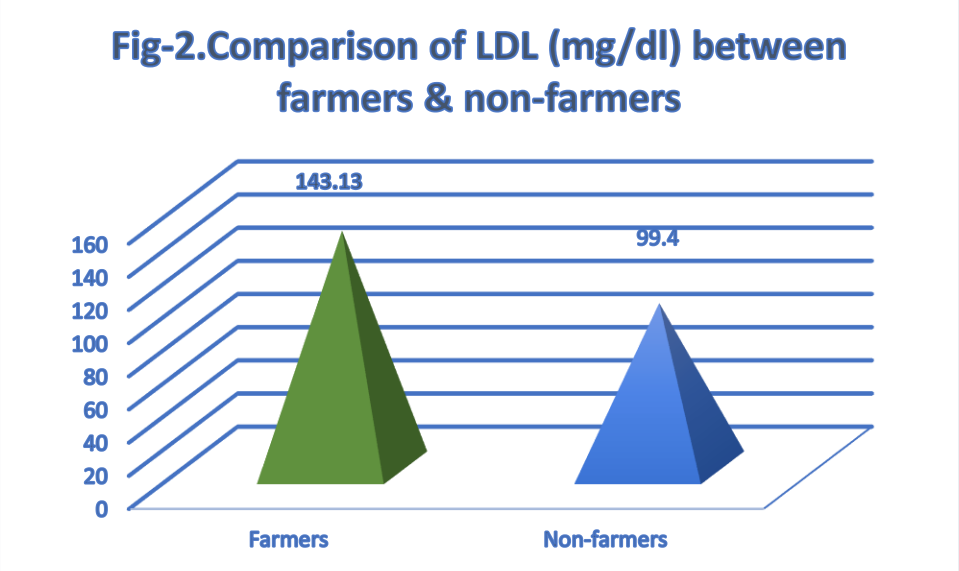
Discussion:

In the present study the farmers exhibited high value of cholesterol and low-density lipoprotein than that of non-farmers counterpart. Graphical representation of the date is presented in Figure1 & 2.

It was determined that increasing the level of HDLC required at least 2 hours of exercise each week, with frequency or intensity of exercise having no impact on lipid profile. (49) However, it was found that exercise frequency had a greater impact on lipid profile than exercise volume or intensity, despite the latter being important. Nevertheless, elderly subjects should exercise at a low to moderate intensity to prevent potential harm, such as injuries, heart attacks, etc. (50)

A high exercise volume was effective in changing lipid profile, according to research by Kraus et al. (51) on 159 people aged 40 to 65. The effects were more noticeable in those who jogged 17 to 18 miles per week as opposed to those who only jogged 11 miles per week. The only individuals with a lower TC/HDLC ratio were those who ran for at least 150 minutes each week. (52)





Following an analysis of the previous research, it was discovered that a number of social and non-social determinants accurately predicted risk factors and patterns related to cardiovascular disease in middle-aged farmers. Despite possibly being in better condition than the general population, according to medical study, farmers have higher than average incidences of cancer and cardiovascular disease. (53) In the United States, heart disease is the leading cause of death in our target population of rural male farmers. (54)

The most prevalent cause of HFpEF or diastolic heart failure is chronic, uncontrolled hypertension (high blood pressure). HFrEF, or systolic heart failure, has uncontrolled hypertension and coronary artery disease as two prevalent underlying causes. (54) Farmers must therefore enhance their cardiovascular health if they want to lower their chance of developing heart failure. Cardiovascular health is defined by the American Heart Association as the existence of desirable health behaviours and traits such exercise, a balanced diet, quitting

smoking, a normal body mass index, and normal blood pressure, blood sugar, and cholesterol levels. (55) According to a qualitative study, men in rural areas follows physical activity as a necessary component of daily life and do not find planned workouts to be possible or practicable. (56)

As part of their regular tasks, farmers spend a significant amount of time operating heavy machinery and lifting and transporting weighty objects. These elements, which include the ongoing pressure to work longer and harder, contribute to elevated stress levels and cigarette use, both of which are significant heart disease risk factors. (57-58) The key stressors for farmers are also cited as unpredictable and frequent seasonal changes, unforeseen plant and animal diseases, financial problems, especially debt, and economic downturns. (58) Long travel distance to get medical care for rural farmers who are exposed to these risk factors may discourage them from making frequent appointments with healthcare providers.

Furthermore, encouraging rural farmers who do not yet have health insurance to enroll for one would have a significant positive impact on their health results. Rural farm employees reported receiving 36% of their income from unemployment insurance, 54 % of respondents indicated they were not covered, while 8 % were unaware. (59)

Stress, notably financial stress, is the main risk factor for heart attacks in male farmers who live in rural areas. (60–61) A person's blood pressure and cholesterol may increase when they are under a severe stress. Additionally, when they are less involved to exercise. (62-63) Stress hormones like cortisol and adrenaline that are high due to chronic stress raise a person's risk of cardiovascular problems. Studies have also shown that stress can alter the mechanism of blood clots which increases the risk of heart attacks. (63) The patients' stress reduction and the inclusion of physical activity are the main goals of the wellness programme.

Table-3. Percentage difference of Lipid Profile between farmers and non-farmers are presented in the

Variables	Farmers (Mean)	Non-farmers (Mean)	Mean Difference	% Difference	Ideal Value
Cholesterol (mg/dl)	220.73	178.73	42	-34% **	<200
Triglycerides (mg/dl)	193.33	167.93	25.4	-22.06%	<150
HDL (mg/dl)	42.73	43.73	1	1.02	>40
LDL (mg/dl)	143.13	99.4	43.73	-30.37% **	<100

VLDL (mg/dl)	38.73	33.2	5.53	-4.74	<30

** Significant at .05 level of significance

A good number of studies have demonstrated the association of serum lipid levels and the occurrence of CVD in western population samples (64–67), which are relatively few in Asian populations. 34% and 30.37% higher value of cholesterol and low-density lipoprotein in case of village farmers than that of non-farmers ware evidence in this study. Although both the village groups of this study exhibited higher value of lipid profile except HDL, but Cholesterol and LDL were significantly higher for farmers than the non-farmers. The increment of selected biochemical parameters of both the groups in respect to reference values specially farmers can be discussed in the following two heads;

A. determinants:

Due to the numerous risk factors involved in the occupation, farming is one of the risky professions in the nation. The objective should be to educate rural male farmworkers about the risks of developing heart disease. Despite the fact that farmers are associated with number of cardiovascular health risks, the majority can be avoided by lowering these risk factors and carrying out early screening for farmworkers (54). The social determinants of health play a crucial role for middle-aged male farmers with hyperlipidemia.

- **Occupational workload:** Farmers spend majority of time in the paddy field for growing corps for us, sometimes they have to carry and lift heavy items as a part of their daily activities. Consistent overwork with high pressure for a longer period of times, contribute to increased stress levels which are major risk factors for dyslipidaemia and CVD (58-59).
- **Health Care Facilities:** Like the metropolitan ones, the rural healthcare facilities fall short of expectations. Additionally, there are not enough healthcare providers, which may prevent rural farmers who are exposed to these risk factors are unable to travel long distance for making frequent appointments with healthcare professionals. They do not receive health insurance or other benefits relating to their health. For the village farmers, early clinical interventions and early disease identification are also in doubt.

- **Literacy & Education:** About 35% of rural farmers, according to the National Center for Farm Workers' Health (NCFH), claim not being able to speak English at all, highliting the need for low-literacy level handouts available in various languages (59). In addition, at the time of presentations, providing charts, and distributing illustrations, the availability of translators will aid in providing these patients with high-quality care. Due lack of education, they are sometime careless about health issues and lifestyle.
- **Family size:** A large number of family members are also burden for the farmers to stay positive and live healthy. Their living house is also unhealthy and clumsy due to large members in the family.
- **Stress:** All person's blood lipid biochemical characteristics are significantly increased by stress, and village farmers are not an exception. Primary stresses for farmers include unexpected animal and plant disease, rapid climate change related to farming, financial difficulties brought on by poor income, including debt, economic downturns, labour pressure, and a lack of access to nutrient-rich meals. (58) . Stress hormones like cortisol and adrenaline that are high due to chronic stress raise a person's risk of cardiovascular problems. Studies have also shown that stress alters how blood clots, increasing the risk of heart attack. (63)

B. Personal determinants:

- **Food & Nutrition**: Fruit and vegetable consumption in India is poor, especially for lower income groups. According to a survey from The National Family Health Survey-3 (NFHS-3), only half of the population consumed one serving of fruit or none at all. The NFHS-3 also revealed a social gradient in fruit intake, with people in the lowest socioeconomic strata consuming a very small amount of fruit each week (69). The high price of fresh fruit and vegetables may help to explain this. (70) In addition, the vegetables eaten in Indian meals are overcooked, resulting in the crucial loss in micronutrients. (71) The majority of the total fat consumed by Indians comes from partially hydrogenated vegetable oils with high trans-fat contents, and consumption of these oils is especially common among urban adult slum dwellers who belongs to the lowest socioeconomic status (SES), (72–73) Although the percentage of carbohydrates consumed has remained relatively stable, refined grain product consumption has increased in comparison to the consumption of unrefined grain products (70)

- **Physical Activities:** Physical activity (PA) has been found to improve lipid profiles by increasing levels of high-density lipoprotein cholesterol (HDL-C) and decreasing levels of triglycerides (TG) (74–76). The mechanism underlying this effect may be due to the enhancement of endothelial function (77). The village farmers get less time and scope for participate in regular physical activity programme. They are also not participating in recreational active activities rather they prefer to spend time by playing cards as recreation.
- **Smoking:** According to clinical studies, smoking is linked to a more atherogenic lipid profile (78–80), which is marked by higher total cholesterol and triglycerides and lower levels of HDL cholesterol (HDL-C). In particular for women, quitting smoking enhanced HDL-C, total HDL, and big HDL particles. Quitting smoking had no impact on LDL or LDL size. Increases in HDL may partially explain the decreased risk of cardiovascular disease seen after quitting smoking, according to Adam D. Gepner. (81). In the present study all the farmers and non-farmers are belongs to category of smokers, specially without filter bidi smoker.
- Alcohol has a variety of impacts on lipid metabolism, including preventing the liver from oxidising fatty acids and limiting the production of novo fatty acids. Frequent side effect of alcohol is an increase in plasma triglyceride levels. Alcohol consumption increases the production of VLDL in the liver, presumably by preventing the liver's oxidation of free fatty acids, which subsequently encourages the production of triglycerides and VLDL (82). Alcohol use often results in a Type IV lipoprotein pattern (more VLDLs), but people who already have a primary lipid problem may experience severe hypertriglyceridemia (Type V). Regular alcohol consumption increases plasma HDL levels.

In general the classical stress hormones, catecholamines (epinephrine and norepinephrine) and glucocorticoids (cortisol), are catabolic and control the breakdown of proteins, triglycerides, and glycogen into molecules that may be quickly digested to provide energy (Black, 2002, 83). Blood concentrations of total cholesterol, low-density lipoprotein (LDL), apoprotein B, triglycerides, and free fatty acids all quickly and briefly rise during acute stress (Stoney, 2007,84). Dyslipidemia has been demonstrated to be sustained under chronic stress circumstances and may endure even after the stressor is gone (Neves et al., 2009,85).

Glucocorticoids may phosphorylate and/or down-regulate perilipin, which covers the surface of lipid droplets to prevent lipase access to the triglyceride core within the droplet. This activity facilitates the lipolysis of triglycerides in fatty acids and glycerol (Xu et al., 2001,86). The activation of glucocorticoids and fatty acids by this kicks off a vicious cycle that causes the liver to generate and secrete increasing amounts of triglycerides

in VLDL particles. Additionally, norepinephrine and cortisol suppress lipoprotein lipase activity, which impairs triglyceride clearance and increases blood levels of VLDL, IDL, and LDL while decreasing HDL levels (Stoney, 2007,84). Further, norepinephrine reduces hepatic triglyceride lipase activity, which encourages high levels of lipoproteins rich in triglycerides in the blood (Stone,2007, 84).

The finding of this study is in agreements with the above-mentioned facts. Comparison between farmers and non-farmers, farmers are more stressed, less active and more unhealthy life style which may be the reason of significant higher value of cholesterol and LDL of male farmers. The hypothesis regarding Cholesterol and LDL are accepted, whereas, Hypothesis for VLDL, HDL and Triglycerides are rejected and alternative hypothesis is accepted.

Conclusion:

Farmers are playing a vital role in the society by devoted themselves for production of corps and foods for the nation, but they are very vulnerable in health issues, especially CVD. Male farmers from the age group of 45 and above are riskier in this regard. In the present study male farmers aged from 45 to 55 years showed high value of cholesterol and LDL than non-farmers, whereas other lipid markers in the blood are unchanged. Awareness about health, lifestyle modification, literacy, nutritional modification, regular physical activities and periodical clinical health status checking is highly recommended along with stress management intervention. Government, semi government and privet sectors should take initiatives by adopting policies to protect farmers and uplift the health status of the nation.

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