

COMPARATIVE STUDY OF LIPID PROFILE AND FASTING BLOOD GLUCOSE AMONG VEGETARIANS AND NON VEGETARIANS

Ravi Bharatkumar Thaker*, Paras Arvindbhai Parekh**

*Assistant professor, Department of Physiology, Pacific medical college and hospital, Udaipur- 313001, Rajasthan.

**Assistant professor, Department of Physiology, Ananta institute of medical sciences and research center, Rajsamand-313202, Rajasthan.

Abstracts: Background: Cardiovascular diseases (CVD) one of the major chronic diseases and leading cause of death. One important risk factor for cardiovascular diseases is hyperlipidemia. Our diet determines development of hyperlipidemia to a great extent. **Objective:** Comparison of effect of vegetarian and non vegetarian diet on lipid profile and fasting blood glucose level. **Methods:** Present study was conducted among 100 males of lower middle socioeconomic class of bhuwana village who were divided into two groups based on their diet either vegetarian or non vegetarian. 55 and 45 subjects were included in each group respectively. A questionnaire containing detailed diet history was filled by each subject. Lipid profile and fasting blood sugar were recorded. Data were analysed by applying appropriate statistical test. **Results:** Mean value of total cholesterol, LDL among non vegetarian subjects were 210.60mg/dl, 127.56mg/dl respectively, which was higher than mean value of 171.94mg/dl, 104.46mg/dl respectively in vegetarian group ($P < 0.05$). While mean serum triglyceride and HDL was found to be higher in vegetarian subjects which was 135.06mg/dl and 43.47mg/dl, as compared to non vegetarian subjects having mean value of 112.75mg/dl and 41.63mg/dl respectively ($P < 0.05$). Fasting blood sugar of vegetarians was 96.48mg/dl while that of non vegetarians was 90.30mg/dl ($p > 0.05$) **Conclusion:** Non vegetarian diet alters the lipid profile. Fasting blood glucose is normal in both groups.

Key Words: Fasting blood glucose, hyperlipidemia, lipid profile, non vegetarian, Vegetarian.

Author for correspondence: Paras Arvindbhai Parekh, Assistant professor, Department of Physiology, Ananta institute of medical sciences and research center, Rajsamand-313202, Rajasthan. E-mail: paras_parekh13@yahoo.com

Introduction

Cardiovascular diseases (CVD) one of the major chronic disease, which is the leading cause of death. In India, the death rate from CVD has increased at an alarming rate and is estimated currently as 52 per cent¹. One of the major risk factors for cardiovascular diseases is hyperlipidemia. Cholesterol disorders or scientifically termed dyslipidemia refers to the clinical conditions produced by lipid aberrations, thus raising the cholesterol and triglyceride levels^{2, 3}. Recent study says 80% of cholesterol is produced by liver while only 20% is contributed by dietary sources.⁴

There is great dispute whether vegetarian diet is better or non- vegetarian. The natural diet of man consists of fruits, nuts and grains, not meat. Then the question arises why do large numbers of people eat animal flesh? There is a variety of reasons for people having a non-vegetarian diet. Most people are concerned about their health and

many people have the think that non-vegetarian foods being rich in protein and iron are the only source for getting all the nutrients that can make them strong, healthy and active. It is also well known fact that many essential amino acids are only available in animal proteins.

Vegetarian diet is that which excludes all food which is cooked from dead animals. Vegetarians do not eat meat or meat products, but may consume milk, dairy products. This diet, when appropriately planned and balanced, is healthful and provides health benefits, because it acts both in the prevention and in the treatment of diseases⁵. Saturated fats, such as animal fats and cholesterol play an important role in person's health. Although some fats are necessary in a balanced diet for body maintenance, saturated fats can be hazardous to one's health, if taken in excess amounts. Diets high in saturated fats and cholesterol, increase cholesterol level in blood and produce atherosclerosis, which leads to heart

disease and stroke. Epidemiological studies on vegetarians show that appropriately planned vegetarian diets are healthy and nutritionally adequate⁶. Compared to omnivorous diets, vegetarian diets can provide several health benefits. Vegetarians have a lower prevalence of overweight and obesity also lower risk of IHD, diabetes and diverticular disease compared with non-vegetarians from a similar background, whereas the data are equivocal for stroke.⁷ The long-term health of vegetarians appears to be generally good, and for some diseases and medical conditions it may be better than that of comparable omnivores. However, these positive health-related outcomes in vegetarians can be influenced by factors other than dietary practice. The lipid profile is a blood test done to assess the status of fat metabolism in the body and is important in heart diseases. High circulating serum cholesterol, low density lipoprotein- cholesterol (LDL-C) and serum triglycerides are major risk factors of this disease⁸.

Aims and objectives:

- Impact of different composition of vegetarian as well as non vegetarian diet on lipid profile and blood glucose.
- To know effect of different composition of non vegetarian diet such as egg, fish, meat on lipid profile.

Material and Methods

Present cross sectional- observational type of study was conducted among 100 male individuals of 25-40 years residing at the bhuwana village. Reason behind selection of this age group was to exclude effect of normal ageing process on lipid profile as well as blood glucose level since effect of diet on these parameters is chronic. Prior approval from the institute ethical committee was taken. Out of 100, 55 subjects were strict vegetarian while 45 subjects eat different varieties of non vegetarian food that includes egg, meat (red +white) and fish. Frequency of eating non vegetarian food was at least 3 days in week. Socio economic class of all subjects was lower middle according to Kupuswamy classification.⁹ As composition and quality of diet may change in

different socio economic group, subjects were selected from same locality and socio economic class. All selected subjects were skilled workers who were engaged in mild-moderate type of physical activity (metabolic equivalent task-MET <6) and neither exposed to regular exercise nor regular fast food eater. Preferred method of cooking was fry with use of soyabean oil as it is cheaper and easily available in study area. The subjects were selected by simple random sampling. Subjects with family history of diabetes, hypertension or cardiovascular event, personal history of any chronic disease like diabetes, hypertension or any autoimmune disease, addiction of alcohol, tobacco, smoking, people taking steroidal drugs, people who were acutely ill were excluded from the study.

The data was collected by means of a personal interview and history taking. All the subjects were asked to fill a Performa containing details regarding demographic profile, medical, family, personal, diet history. In diet history whether they are vegetarian or non-vegetarian, type of food intake, food with addition of sugar/ 'gud' to 'dal' and vegetables, addition of oil in making dough, type of oil used in cooking, quantity of oil/ghee and sugar/ 'gud' consumed in the household per month per person, frequency of eating out, frequency and quantity of having sweets and fried food/ snacks/ junk food, frequency and quantity of fruit and vegetable intake, frequency and quantity of dairy products like cheese, paneer and milk made items were also considered.

After personal interview physical examination including height, weight, hip and waist circumference, blood pressure measurement was conducted.

Lipid profile of each subject measured in early morning after overnight fast by portable LipidPlus machine (JantPharmaceutical Corporation, Encino CA). Blood glucose level was recorded by glucometer (Accu-chek active glucometer). An informed consent of all the participants was taken prior to commencing the study.

We considered following normal range of values for the various parameters.

Lipid profile: Total cholesterol (TC) 150-200 mg/dl, Low Density Lipoprotein (LDL) fraction 80-150 mg/dl, High Density Lipoprotein (HDL) fraction 30-

60 mg/dl, Fasting Serum Triglyceride (TG) 75-150 mg/dl¹⁰.

Blood pressure: systolic blood pressure (SBP) \geq 140 mmHg and / or diastolic blood pressure (DBP) \geq 90 mmHg taken as hypertensive. Rest all were taken as Non hypertensive (pre hypertensive and normotensive). (JNC 7 report on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, U. S. Department of Health and Human Services)¹¹.

Body mass index (BMI): BMI \geq 30 kg/m² were classified as being Obese and those with BMI \geq 25 kg/m² but <30 kg/m² were identified as being Overweight (Global database on BMI, WHO 2005)¹².

Waist Hip Ratio (WHR): a WHR > 1.0 in males was taken as abnormal (Waist Circumference and Waist–Hip Ratio: Report of WHO Expert Consultation 2008)¹³.

Fasting blood glucose: <100mg/dl- normal, 100-125mg/dl- prediabetes, >125-diabetes (American diabetes association)¹⁴.

Statistical analysis:

The data was analyzed using Microsoft excel by applying unpaired t-test for quantitative data and using Epi Info 7 version 7.0-8.3. Significance level was taken as $p < 0.05$.

Result:

Table1: Baseline characteristics of Vegetarian and Non vegetarian subjects.

	Vegetarian (Mean \pm SD)N=55	Non vegetarian* (Mean SD)N=45 \pm
Age(years)	35.41 \pm 4.49	34.55 \pm 4.09
Weight (kg)	70.44 \pm 9.18	70.41 \pm 14.15
Height (m)	1.67 \pm 0.09	1.65 \pm 0.07**
BMI (kg/m ²)	25.23 \pm 2.89	26.50 \pm 4.50
WHR	0.80 \pm 0.07	0.80 \pm 0.10
SBP (mm of Hg)	122.89 \pm 11.62	126.32 \pm 6.42

DBP(mm of Hg)	83.67 \pm 6.42	85.14 \pm 5.79
MBP(mm of Hg)	99.41 \pm 7.93	99.86 \pm 5.53
Pulse rate	80.98 \pm 11.60	77.39 \pm 6.46**
Average calorie intake (calorie per person/day)	2159.35 \pm 87.74	2192.96 \pm 90.53
Total cooking oil consume (ml/person/month)	681.36 \pm 58.26	688.40 \pm 59.21
Total sugar intake(mg/ person/month)	900.16 \pm 40.68	875.56 \pm 37.49**

*frequency of eating non vegetarian food at least 3days a week

** $p < 0.05$

Table 2: Comparison of Lipid profile in Vegetarian and Non- vegetarian subjects

Lipid profile (mg/dl)	Vegetarian (Mean \pm SD) N=55	Non-vegetarian* (Mean \pm SD) N=45
TotalCholesterol	171.94 \pm 19.42	210.60 \pm 28.96**
LDL	104.46 \pm 13.50	127.56 \pm 19.25**
HDL	43.47 \pm 3.79	41.63 \pm 2.83**
S. Triglyceride	135.06 \pm 11.20	112.75 \pm 12.18**
LDL/HDL Ratio	2.49 \pm 0.48	3.14 \pm 0.58**
T.Chole./ HDL	4.05 \pm 0.70	5.13 \pm 0.80**

*frequency of eating Non vegetarian food at least 3days a week

**p<0.05

Table 3: Different food type preference among non vegetarian subjects (n=45)

Non-vegetarian food type*	Meat	Egg	Fish	Egg+fish	Egg+Meat	Fish+Meat	All three
No. of subjects	17	2	0	9	9	4	4

*frequency of eating non vegetarian food at least 3days a week

Table 4: Comparison of lipid profile among different pattern of non vegetarian food

Lipid profile (mg/dl)	Meat (red+white) (Mean±SD)	Egg (Mean±SD)	Egg+Fish (Mean±SD)	Egg+Meat (Mean±SD)	Fish+Meat (Mean±SD)	All three (Mean±SD)
TC	224.79±25.46*	200.15±24.13	169.39±18.56*	235.37±26.35	223.79±23.47	200.9±0.98
LDL	136.85±12.89*	127.56±11.74	110.71±10.36*	130.87±12.50	140.38±13.27	130.45±12.36
HDL	40.28±3.26*	41.50±3.68	43.20±3.17*	42.50±3.08	40.9±3.04	41.30±3.74
TG	117.35±11.	118.17±	116.87±	108.67±10.	105.98±10.	120.34±

	36	12.49	11.78	89	42	10.39
LDL/HDL	3.41±0.36	3.19±0.26	2.60±0.46	3.05±0.24	3.45±0.78	3.21±0.21
TC/HDL	5.61±0.98	4.85±0.74	3.98±0.56	5.55±1.12	5.45±1.28	4.87±0.47

*p<0.05

Table 5: Comparison of fasting blood sugar level in vegetarian and non vegetarian subjects

	Vegetarian (Mean±SD) N=55	Non-vegetarian* (Mean±SD)N=45
Fasting blood glucose(mg/dl)	96.48±8.24	90.30±9.45**

*frequency of eating non vegetarian food at least 3days a week

**P<0.05

Discussion: The present study is a cross sectional study of people aged 25-40 years residing in the bhuwana village. The aim of the study was to assess effect of vegetarian and non vegetarian diet on lipid profile and blood sugar level and to know which type of diet is better than another. As per table 1 both groups are comparable for most of the baseline characteristics (p>0.05) except height, pulse rate and average intake of sugar. All three parameters were higher among vegetarians as compared to non vegetarians (p<0.05). BMI of both the groups fall under overweight category. Blood pressure is comparable in both groups which are in contrast to result of Yokoyama et al¹⁵ and Ophir et al¹⁶ in which vegetarians exhibit lower BP than non vegetarians. Approximate total calorie intake per person and consumption of cooking oil /person/month were within normal range and groups do not show any significant difference. Soyabean oil is very popular for cooking in this part of India.

Average per capita sugar consumption among vegetarians is significantly high (table 1) as compare to non vegetarians however it is within normal range of 35mg/day as suggested by American diabetes association¹⁷. Excess sugar intake can cause cardiovascular disease. Jean welsh et al¹⁸ found that people who consumed increased amount of added sugar had increased blood levels of harmful fats. LDL and TG were increased while HDL was decreased. In our study mean fasting blood glucose level among the study groups was within normal range.

Mean total cholesterol, LDL, LDL/HDL ratio, and total cholesterol/HDL in non vegetarian subjects are 210.60mg/dl, 127.56mg.dl, 3.14 and 5.13 respectively, which is higher than mean value of 171.94mg/dl, 104.46mg/dl, 2.49 and 4.05 respectively in vegetarian group ($p < 0.05$)

While mean serum triglyceride and HDL is found to be higher in vegetarian subjects which is 135.06mg/dl and 43.47mg/dl, as compared to non vegetarian subjects having mean value of 112.75mg/dl and 41.63mg/dl respectively ($p < 0.05$).

Result of this study matches with study done by Alexander et al¹⁹ and Li et al²⁰ indicated that meat-eaters had a significantly higher cluster of cardiovascular risk factors compared with vegetarians, including increased body mass index, waist to hip ratio, plasma total cholesterol, triacylglycerol, LDL levels, ratio of TC/HDL and LDL/HDL, though in our study serum triglyceride is found to be more in vegetarians. It is a well known fact that a high consumption of plant based foods such as fruit and vegetables, nuts and whole grains reduces risk of coronary artery disease and stroke. This vegetarian diet provides protection because of mono and polyunsaturated fatty acids, n-3 fatty acids, antioxidant vitamins, minerals, phytochemicals, fibre and plant protein^{21,22}.

Among non vegetarian subjects, various pattern of consumption of non vegetarian food is seen (table 3). These are egg only, meat (red +white) only, egg and meat, fish and meat, egg and fish and all three. Significant difference ($P < 0.05$) in blood lipid profile is seen in subjects consuming only meat with total cholesterol and LDL 224.79mg/dl and 136.85mg/dl respectively as compared to consumers of fish and egg with total cholesterol and LDL are 169.39mg/dl

and 101.71mg/dl respectively (table 4). Also HDL is higher in fish and egg eaters with 43.20mg/dl as compared to only meat eaters 40.28mg/dl. Research worldwide has indicated that eating fish regularly- one or two servings weekly is beneficial. Fish is low in fat; high in protein and an excellent source of omega 3 fatty acids which reduces incidence of heart disease²³. We couldn't find an exclusive fish eater since study area is far away from costal line, it was difficult to define lipid profile among exclusive fish eaters. Higher values also found in consumers of egg only with total cholesterol and LDL is 200.15mg/dl and 127.56mg/dl respectively.

Conclusion

Total cholesterol and low density lipoprotein found higher among non vegetarians while high density lipoprotein and triglycerides elevated among vegetarians. Non vegetarian subjects should limit the intake of meat. Fasting blood glucose and blood pressure were within normal range.

References:

1. Gupta M.K. CVD death rate in India. In: Causes, cure and prevention of high blood cholesterol. 2nd edition: Diamond Pocket Books Pvt. Ltd. 2016. 117-118
2. Okamura T. Dyslipidemia and cardiovascular disease: a series of epidemiologic studies in Japanese populations. *J Epidemiol.* 2010; 20: 259–265.
3. Ferdowsian HR, Barnard ND. Effects of plant-based diets on plasma lipids: *Am J Cardiol.* 2009; 104: 947–956.
4. Julie Corliss: how it is made, cholesterol production in your body; Harvard health publishing, Harvard medical school, feb 2017
5. Association Dietitians of Canada. Position of the American Dietetic: Vegetarian Diets. *J Am Diet Assoc.* 2000; 103 (6):748-65.
6. Craig WJ, Mangels AR, American diabetic association, Position of the American Dietetic Association: Vegetarian Diets. *Journal of Am. Diet. Assoc.* 2009 jul; 109(7):1266-1282.
7. Key TJ, Appleby PN, Russell MS. Health effects of vegetarian and vegan diets. *Proc. Nutr. Soc.* 2006 feb; 65(1), 35-41.
8. Das S, Yadav D, Narang R, Das N. Interrelationship between lipid peroxidation, ascorbic acid and superoxide dismutase in

- coronary artery disease. *Current Science* 2002 august; 83(4), 488–491.
9. Park K. kuppuswammy classification. In: textbook of preventive and social medicine. 24th edition. Bhanot publishers. 2017:727
 10. Satyanarayana U. lipid metabolism in Biochemistry: 5th edition Elsevier; 2017: 317-323
 11. Martin J. Hypertension guidelines: Revisiting the JNC recommendations, *The journal of Lancaster general hospital*, 2008; volume 3(3):91-97.
 12. Nguyen DM, El-Serag HB. The Epidemiology of Obesity. *Gastroenterol Clin North Am.* 2010 March; 39(1): 1–7.
 13. Waist Circumference and Waist–Hip Ratio: Report of WHO Expert Consultation. WHO. Geneva. 2008. Available from: http://www.who.int/nutrition/publications/obesity/WHO_report_waistcircumference_and_waisthip_ratio/en/index.html
 14. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2010; **33**(Suppl 1): S62–9.
 15. Yokoyama Y, Nishimura K, Barnard ND, et al: Vegetarian diets and blood pressure: a meta-analysis. *JAMA Intern Med.* 2014; 174:577–587.
 16. Ophir O, Peer G, Gilad J, Blum M, Aviram A: Low blood pressure in vegetarians: the possible role of potassium. *Am J Clin Nutr* 1983; 37:755-762.
 17. Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA et al :Diet and lifestyle recommendations revision 2006: a scientific statement from the American Heart Association Nutrition Committee. *Circulation.* 2006; **114**: 82–96
 18. Jean A. Welsh, RN Andrea Sharma, Jerome L. Abramson, PhD Viola Vaccarino, Cathleen Gillespie, Miriam B. Vos, *journal of American medical association* 2001.;303(15);1490-1497
 19. Alexander H., Lockwood, LP, Harris MA. And Melby C.L. Risk factors for cardiovascular disease and diabetes in two groups of Hispanic Americans with differing dietary habits. *Journal of American College of Nutrition*, 1999 18 (2): 127-136.
 20. Li D, Sinclair A, Mann N, Turner A, Ball M, Kelly F, Abedin L. And Wilson A. The association of diet and thrombotic risk factors in healthy male vegetarians and meat-eaters. *European Journal of Clinical Nutrition*, 1999 53 (8) : 612-619.
 21. Li D. Chemistry behind vegetarianism. *J Agric Food Chem.* 2011; 59: 777–784.
 22. Hu FB. Plant based foods and prevention of cardiovascular disease: an overview. *Journal of American College of Nutrition*, 2003 78 : 544S-551S.
 23. Mozaffarian D, Rimm EB: Fish intake, contaminants and human health: Evaluating risks and benefits. *JAMA* ; 2006 Oct 18;296(15):1885-1899

Disclosure: No conflicts of interest, financial, or otherwise are declared by authors