



Original Research Article

Role of cholesterol in cognitive function in the elderly

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ABSTRACT

Background & Aim: The role of cholesterol in Cognitive Decline is less known as compared to other pathologies linked with dyslipidaemia. However, Cholesterol is well-known to have multiple functions in normal functioning of the brain and the aging process. This study therefore aimed at finding a co-relation, if any, between Cholesterol and age-related cognitive decline.

Objective: To assess Cognitive Function of subjects and compare it with respective blood cholesterol levels.

Material and Methods: The study included 50 elderly subjects from Maharashtra (females: 12%) assessed using Marathi version of Mini Mental State Examination (MMSE) and their cholesterol blood concentrations obtained using a Lipid Profile investigation. Cholesterol levels and cognitive function was then co-related using statistical analysis.

Results: The subjects with a higher Total Cholesterol & LDL Cholesterol had slightly less scores on the Mini Mental State Examination (MMSE) Test. However, the difference was found to be significant.

Conclusion: Based on the results obtained, no relevant co-relation could be found between Blood Cholesterol Levels and Cognitive Function

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1. Introduction

Cholesterol plays a diverse array of functions in the human body such as maintaining cell membrane fluidity, synthesis of neurotransmitters, synthesis of hormones & enzymes, synthesis of Vitamin D3 etc. All such aspects of cholesterol function are vastly studied and pathologies of the same are linked with abnormal levels of cholesterol. High levels of cholesterol are also known as a major risk factor for cardiovascular pathologies but the role of cholesterol in cognition and memory impairment is, in comparison, less known. Cholesterol unmistakably is known to be a

very integral part of brain functions like neural signal transmission, memory and synaptic plasticity.

A significant number of studies show that elevated serum cholesterol is a risk factor for mild cognitive impairment¹⁻⁵ and

Dementia^{6,7} and that it can be associated with Cognitive Functions⁵⁻¹¹ However, in the very elderly, the results of such studies have been inconsistent.^{12,13} Research is, therefore, required to further our understanding of the factors affecting this condition, including levels of cholesterol.

This study aimed to further the knowledge of role of cholesterol levels in cognition by assessing the cognitive scores of the subjects by means of Mini Mental State

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Examination, and comparing them with the Cholesterol levels investigated in a Lipid Profile Test. By collection, compilation and analysis of the acquired data, the study hoped to establish a co-relation between serum cholesterol levels and Cognitive decline.

2. Aim

To explore the co-relation between Blood Cholesterol levels and Cognitive function in the elderly.

3. Objectives

1. To assess the cognitive function of subjects using Mini Mental State Examination.
2. To investigate Blood Cholesterol levels of subjects.
3. To find co-relations, if any, between Blood Cholesterol levels and Cognitive Function

4. Materials and Methods

4.1. Study population

This study was based on participants aged over 60 years primarily based in rural areas of western region of India and was conducted in 2017 using biochemical investigations and questionnaire based cognitive assessment.

Out of 62 potential candidates, 8 were excluded on account of being illiterate & therefore unable to answer the questionnaire, 3 were excluded on account of being unable to seeing clearly & therefore unable to complete the last task of MMSE (copying a picture with pencil) and 1 candidate was excluded on account of having severe reduced hearing and therefore being unable to follow the instructions given by the investigator, effectively leaving 50 subjects. The study was approved by the Institutional Ethics Committee. Informed Consent was obtained from all the participants of the study.

4.2. Cognitive function assessment

The Cognitive function of the subjects was assessed using the validated Hindi version of Mini Mental State Examination by PAR Inc.

MMSE scores range from 0 to 30, with the indication that higher scores reflect better cognitive function. Moreover, a score of 23 or below indicates mild cognitive impairment and a score of 17 or below indicates severe cognitive impairment.

Blood Cholesterol Level Assessment: The Blood levels of Total, HDL and LDL Cholesterol were obtained via Phlebotomy of Medial Cubital vein after Overnight 12-hour fasting using Automatic Biochemistry Analyzer in the Central Clinical Laboratory of Acharya Vinoba Bhave Rural Hospital. Less than 130.32 mg/dl of LDL cholesterol concentration is considered normal. The normal level of Triglycerides concentration is less than 150.58 mg/dl. More

than 59.94 mg/dl of HDL-C concentration is the normal expected level. Less than 200.3 mg/dl Total Cholesterol is considered desirable.

4.3. Statistical analysis

To find & establish any co-relation of blood cholesterol levels to cognition, the sample population was split into 3 sub-groups based on their respective Total Blood Cholesterol, HDL Cholesterol levels, Triglyceride levels and LDL Cholesterol levels based on guidelines given by WHO and NCEP. The Mean value of each parameter was then compared with the Mean MMSE Score of the respective sub-group member subjects to find any co-relation.

GraphPad Prism 7 software was used for the aid statistical analysis. Formal hypothesis testing was 2-sided with a significant level of 0.05.

5. Results

Out of the 50 subjects, 12 were women. The Mean Age was 63.76.

Based on Blood Cholesterol levels, the subjects were divided into 3 categories each for Total Cholesterol, HDL Cholesterol, LDL Cholesterol and Triglycerides: Desirable, Borderline and High/Low based on WHO and NCEP guidelines.^{14,15}

Table 1:

Classification	TC	HDL	TG	LDL
Desirable	<200	>60	<150	<130
Borderline	200-239	35-59	200-399	130-159
High	>240	—	>399	>160
Low	—	<35	—	—

5.1. Comparison of total cholesterol & MMSE score

Upon comparison, the subgroup with High levels was found to have slightly lower MMSE scores. However, no statistically significant co-relation (p -value ≤ 0.05) could be established between total serum cholesterol and Cognitive function.

Table 2:

	Subgroup 1 (Desirable)	Subgroup 2 (Borderline)	Subgroup 3 (High)
N=	19	27	4
Mean (mg/dl)	159.7	209.75	251.35
MMSE Mean	27.22	27.18	26.91

5.2. Comparison of LDL cholesterol & MMSE score

No significant co-relation could be established between LDL cholesterol and Cognitive function.

Table 3:

	Subgroup 1 (Desirable)	Subgroup 2 (Borderline)	Subgroup 3 (High)
N=	8	29	13
Mean (mg/dl)	102.42	145.78	197.2
MMSE Mean	26.13	27.11	26.85

5.3. Comparison of HDL cholesterol & MMSE score

No significant co-relation could be established between HDL cholesterol and Cognitive function.

Table 4:

	Subgroup 1 (Desirable)	Subgroup 2 (Borderline)	Subgroup 3 (Low)
N=	18	12	20
Mean (mg/dl)	84.3	41.24	18.95
MMSE Mean	27.13	27.11	27.05

5.4. Comparison of triglycerides & MMSE score

No significant co-relation could be established between Triglycerides and Cognitive function.

Table 5:

	Subgroup 1 (Desirable)	Subgroup 2 (Borderline)	Subgroup 3 (High)
N=	18	26	6
Mean (mg/dl)	81.49	270.9	412.2
MMSE Mean	27.13	27.11	27.05

6. Discussion

This study of 50 subjects regarding Cognitive function and Blood Cholesterol was unable to establish any statistically significant link between the same. However, other studies in the past have to some extent been able to co-relate the two parameters successfully.¹⁶ It is also worth noting that this study did not consider into account some factors that future research may suggest affects “Cholesterol-dependant” cognitive decline, such as Homocysteine,¹⁷ entry-age, Statin non-use,¹⁸ interleukin-6 and Alpha-1-antichymotrypsin^{19–21}

6.1. Drawbacks of the study

1. The sample size of this study was 50 elderly subjects which is not an adequate size for a study exploring the

functional depth of Cognition and factors affecting it.

2. The study was conducted over a span of four months which is not adequate time to explore the avenues & extents of Cognitive decline in the elderly.
3. This study failed to adjust the parameters with respect to a number of factors that are likely to affect cognition or Cholesterol levels such as Age, Sex, Alcohol use, Smoking, Statin use or non-use, Literacy level, multilingualism, history of Depression & BMI.

7. Conclusion

Even though, no statistically significant co-relation was established in this study between Cholesterol and Cognitive function, this is barely one of many studies that need to be done in order to explore Cognitive decline in the elderly and the various factors affecting cognition. The need of the hour is even greater for such studies as we reach the time of a “global-aging” with a majority of the population growing old.

Therefore, more studies like this one must be conducted, preferably with a Cohort model and multi-factorial approach in considerably large sample sets.

8. Source of Funding

None

9. Conflict of Interest

None.

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