Original Research

A comparative study of serum lipid profile and glucose level between breast cancer patients and controls at tertiary care hospital in India

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ABSTRACT

Aim: The aim of this study is to compare serum lipid profiles: Total cholesterol, triglyceride (TG), high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol, and serum glucose between breast cancer patients and control to evaluate their relationship with breast cancer. **Background:** There are many researches which have reported positive as well as a negative association of plasma/serum lipids and lipoproteins and serum glucose with different cancers. Increase levels of circulating lipids and serum glucose have been associated with breast cancer risk. **Materials and Methods:** A total of 92 consecutive cases of histologically proven carcinoma breast along with same number of age-matched, disease-free controls were selected. Serum lipid and serum glucose levels of both cases and controls were estimated. **Results:** The results of this study suggest that low (HDL-C) level and high (TG) levels are associated with risk of breast cancer in Indian women while serum glucose level does not show any association with breast cancer risk. **Conclusion:** More studies are needed in the future to explore common modifiable risk factors for the development of breast cancer, so that its incidence can be reduced.

Keywords: Breast cancer, lipid profiles, serum glucose, serum lipids

INTRODUCTION

Globally cancer of breast is the most common malignancy among women, whereas it is the second most common cancer among Indian women.[1] A tendency of a rising trend in incidence of breast cancer has been observed in various cancer registries in India.[2] Role of lipid in the pathogenesis of coronary heart disease has been consistently found, researchers have reported association of plasma/serum lipids and lipoproteins with different cancers.[3-6] There are several reports of elevated plasma lipid level in pre and post-menopausal breast cancer patients.[7] Epidemiological studies reveal that high-density lipoprotein-cholesterol (HDL-C) and breast cancer are influenced by variables such as dietary fat intake, alcohol consumption, body weight, country of residence, pregnancy, endogenous hormones, smoking, exercise, and socioeconomic status.[8]

Serum HDL-C level has been shown to be lower in the subject with extensive mammographic dysplasia, which was defined as sheet-like areas of radiological density that were distinguished from the linear densities that characterize prominent ducts and breast occupied by radiological changes at least 75% family history of breast cancer.[9] However, it has been reported that HDL-C level was either elevated or depressed in women with the breast cancer.[10]

The risk for breast cancer increases with a high fat diet, obesity.[3,4] Glucose intolerance is associated with insulin resistance and is produced as a result of increased insulin secretion from β cells which later on lead to β cell exhaustion and occurrence of hyperglycemia.[11] There are few studies which show increased serum glucose levels in breast cancer patients.[12-14] The aim of this study is to compare serum lipid profiles and serum glucose levels between breast cancer patients and control to evaluate their relationship with breast cancer.

MATERIALS AND METHODS

Subjects

The present study was done in the department of Pathology of Chirayu Medical College and Hospital, Bhopal, India from February 2012 to March 2014. A total of 184 subjects were

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studied. They participated as two populations. First group of 92 histologically proven breast cancer patients and other group of 92 controls which was age-matched and disease free.

Blood sample collection and preparation

A volume of 5 ml of fasting blood was collected into the plain tube from each of the subjects. The blood was allowed to clot and then centrifuged at 3,000 rpm for 15 min within 30 min of sample collection and analyzed within 6 h after it's the separation.

Laboratory Assay

The following parameters were analyzed with each sample. (i) Total-cholesterol (T-CHOL) (ii) triglyceride (TG) (iii) HDL-C (iv) low-density lipoprotein-cholesterol (LDL-C) and fasting serum glucose. Serum lipid profile and serum glucose level were estimated with the Cobas c 111 Autoanalyzer (Roche Diagnostic GmbH, Mannheim, Bad Nauheim, Germany) using commercial kits from Roche Diagnostic Products.

Statistical Analysis

All data were analyzed using the Graph Pad software computer program. Odds ratio, relative risk and chi-square test, were performed for comparison between control and patient groups. A value of $P < 0.01$ was considered as statistically significant.

RESULTS

The results under five groups are presented in Tables 1-5.

Table 1 shows the comparison of T-CHOL level between cancer cases and control cases. In both the groups majority of cases and controls T-CHOL value was found to be <200 mg/dl. However T-CHOL range 200-239 mg/dl was found to be increased in cases as compared to control. Statistical analysis did not reveal any significant association between the risk of breast cancer and level of T-CHOL. The mean T-CHOL levels were found to be 174 mg/dl in cases and 161 mg/dl in the control group.

Table 2 shows the comparison of HDL-C level between cancer cases and control cases. In 52.5% of breast cancer

Table 1: Comparison of T-CHOL level

Cholesterol range mg/dl	Number (%)		
	<200	**200-239**	**≥240**
Cancer cases	70 (76.1)	22 (23.9)	0 (0)
Control cases	78 (84.7)	14 (15.3)	0 (0)

Odds ratio=1.75, RR=1.57, χ^2=1.11, *P*<0.29, RR: Relative risk, T-CHOL: Total-cholesterol

Table 2: Comparison of HDL-C levels

HDL-C range mg/dl	Number (%)		
	>60	**35-60**	**<35**
Cancer cases	00 (00)	44 (47.8)	48 (52.2)
Control cases	00 (00)	88 (95.7)	04 (4.3)

Odds ratio=24, RR=12, χ^2=25.95, *P*<0.0001, RR: Relative risk, HDL-C: High density lipoprotein-cholesterol

patients, HDL-C level was found to be <35 mg/dl as compared to 4.3% of the control group which was found to be statistically significant ($P < 0.001$). The relative risk (RR) of breast cancer among women having HDL-C level <35 mg/dl was found to be 12 times more (RR=12) than those having (HDL-C) level between 35 and 60 mg/dl. The mean HDL-C level was found to be 39 mg/dl in cases and 44.4 mg/dl in the control group.

Table 3 shows that majority of breast cancer as well as control group cases had their LDL-C levels <130 mg/dl (cases-82.6%; control-78.2%), while the women having their LDL-C levels between 130 and 159 mg/dl was found in 17.4% as compared to 19.6% of control group. The association of LDL cholesterol level with breast cancer was not found to be statistically significant. The mean LDL cholesterol levels were found to be 106 mg/dl in cases and 119 mg/dl in the control group.

Table 4 shows the percentage of breast cancer patients having their (TG) levels above 160/dl was found to be 37% as compared to 2.2% of the control group. The RR of breast cancer among women having (TG) level >160 mg/dl was found to be 17 times more (RR=17) than those having (TG) level <160 mg. The mean TG level was found to be 148 mg/dl in cancer cases and 95.9 mg/dl in the control group.

Table 5 shows that in 13% of breast cancer cases and control group females fasting serum glucose was found to be >110 mg/dl while 87% of cases and control had their fasting serum glucose level within normal range. The mean fasting serum glucose levels were found to be 92.3 mg/dl in cancer cases and 90.5 mg/dl in the control group.

DISCUSSION

Human mammary tissue metabolizes lipids from plasma under influence of female gonadal hormones. Malignant

Table 3: Comparison of LDL-C levels

LDL-C range mg/dl	Number (%)		
	<130	**130-159**	**≥160**
Cancer cases	76 (82.6)	16 (17.4)	0 (0)
Control cases	72 (78.2)	20 (21.8)	0 (0)

Odds ratio=0.76, RR=0.8, χ^2=0.28, *P*=0.59, RR: Relative risk, LDL-C: Low density lipoprotein-cholesterol

Table 4: Comparison of TG levels

TG range mg/dl	Number (%)	
	<160	**≥160**
Cancer cases	58 (63.0)	34 (37.0)
Control cases	90 (97.8)	02 (2.2)

Odds ratio=26.38, RR=17, χ^2=17.68, *P*=0.0002, RR: Relative risk, TG: Triglyceride

Table 5: Comparison of fasting serum glucose levels

TG range mg/dl	Number (%)	
	70-110	**≥110**
Cancer cases	80 (87.0)	12 (26)
Control cases	80 (87.0)	12 (26)

TG: Triglyceride

proliferation of breast tissue in women has been associated with changes in plasma lipid and lipoproteins levels.[15] Changes in serum HDL-C level-induced by sex steroids may be mediated by changes in hepatic lipase; the activity of this enzyme is regulated by sex steroids.[16] Low serum HDL-C level is related to increased level of free biologically active estradiol throughout an entire menstrual cycle.[17] Malignant proliferation of breast tissue in women has been associated with changes in plasma lipid and lipoproteins level.[15]

Tables 6-10 are showing various relationships of lipid profile and serum glucose levels with previous studies.

As mentioned in Table 6, majority of studies have found that serum T-CHOL level has shown no association with breast cancer risk, but Kumar *et al.* 1991[19] and Ray and Hussain 2001[20] showed a positive association.

Studies conducted as per Table 7, observed negative association of serum HDL-C with breast cancer risk whereas Gaard *et al.*[21] showed no association.

As per Table 8 studies conducted by Hoyer and Engholm 1992[22] Gaard *et al.* 1994[21] and Present study show no association of LDL-C with breast cancer risk whereas, previous studies reported by Kumar *et al.* 1991[19] and Ray and Hussain 2001[20] showed positive association.

The relationship between TG and breast cancer risk in majority of previous studies as shown in Table 9 show positive

Table 6: Association of serum T-CHOL levels with breast cancer

Authors	Serum T-CHOL levels
Kumar *et al.* 1991	Positive association
Ray and Hussain 2001	Positive association
Hoyer and Engholm 1992	No association
Gaard *et al.* 1994	No association
Present study	No association

T-CHOL: Total-cholesterol

Table 7: Association of serum HDL-C levels with breast cancer

Authors	Serum HDL-C levels
Kumar *et al.* 1991	Negative association
Hoyer and Engholm 1992	Negative association
Schreier *et al.* 1999[18]	Negative association
Ray and Hussain 2001	Negative association
Present study	Negative association
Gaard *et al.* 1994	No association

HDL-C: High density lipoprotein-cholesterol

Table 8: Association of serum LDL-C levels with breast cancer

Authors	Serum LDL-C levels
Kumar *et al.* 1991	Positive association
Ray and Hussain 2001	Positive association
Hoyer and Engholm 1992	No association
Gaard *et al.* 1994	No association
Present study	No association

LDL-C: Low density lipoprotein-cholesterol

association including present study while study by Gaard *et al.* 1994[21] was not in agreement with previous studies.

It is evident from the Table 9 that few previous studies show positive association between high serum glucose level and breast cancer risk Muck *et al.* 1975,[12] Sellers *et al.* 1994,[14] Mink *et al.* 2002.[13]

Muti *et al.* 2002[23] has shown that apart from reduction in insulin sensitivity or insulin secretion which cause increased glucose production and decreased glucose utilization, gluconeogenesis is stimulated by counterregulatory hormones such as adrenal hormones, epinephrine, cortical, androgens, and growth hormones. These hormones are determinants of morning fasting glucose and additional studies are needed to clarify the potential etiological role of these hormones in breast cancer.

CONCLUSION

Serum lipids, low HDL, and high serum TG were found to be positively associated with risk of breast cancer in female patients. No association was found between fasting serum glucose level and risk of breast cancer. More studies are needed in the future to explore common modifiable risk factors for the development of breast cancer, so that its incidence can be reduced.

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Table 9: Association of serum TG levels with breast cancer

Authors	Serum TG levels
Hoyer and Engholm 1992	Positive association
Schreier 1999[18]	Positive association
Ray and Hussain 2001	Positive association
Gaard *et al.* 1994	No association
Present study	Positive association

TG: Triglyceride

Table 10: Association of serum glucose levels with breast cancer

Authors	Serum glucose level in breast cancer patients	
	More than normal	Normal
Muck *et al.* 1975[12]	√	
Ragozzino *et al.* 1982[24]		√
O'Mara *et al.* 1985[25]		√
Franceschi *et al.* 1990[26]		√
La Vecchia *et al.* 1994[27]		√
Sellers *et al.* 1994[14]	√	
Hjalgrim *et al.* 1997[28]		√
Manjer *et al.* 2001[29]		√
Mink *et al.* 2002[13]	√	
Present study		√

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PEER REVIEW

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CONFLICTS OF INTEREST

Nil

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