

The role of developing breast cancer in alteration of serum lipid profile

Kamal Eldin A. Abdelsalam, Ikhlas K. Hassan¹, Isam A. Sadig²

Division of Chemical Pathology, Faculty of Laboratory Medicine, Omdurman Ahlia University, ¹AB Research Institute, ²Department of Pathology, Faculty of Medical Laboratory Sciences, Omdurman Islamic University, Omdurman, Sudan

Aims: The major aim of this study is to examine the role of alterations in lipid profile in women developing breast cancer. This study was carried out between May 2009 and December 2010. **Background:** The relationship between lipids and breast cancer is undistinguished. Until now, conflicting results have been reported on the association between lipids and risk of breast cancer development in women. **Materials and Methods:** Plasma lipids (i.e., total cholesterol [TC], high-density lipoprotein [HDL], low-density lipoprotein [LDL], and triglycerides [TG]) were analyzed from 60 controls and 120 untreated breast cancer patients with clinical and histopathological evidence, under aseptic conditions. Venous blood was drawn from the cases and controls and estimations of lipid profile were done utilizing the standard procedures. **Statistical Analysis Used:** Independent sample *t*-test to compare the mean serum levels of lipid profile and TC/HDL ratio between patients and controls. **Results:** A significant rise in serum total cholesterol, low-density lipoprotein cholesterol, and ratio of total cholesterol: high density lipoprotein cholesterol values, whereas high density lipoprotein cholesterol and very low density lipoprotein cholesterol were not affected significantly by the breast cancer. **Conclusions:** The developing breast cancer might be considered as one of the factors in alterations in lipid profile levels.

Key words: Breast cancer, high-density lipoprotein, lipid profile total cholesterol, low-density lipoprotein, triglycerides

INTRODUCTION

The lipid profile—also known as lipid panel—is a group of tests that are often ordered together to determine risk of coronary heart disease.^[1] A physician may ask the patient to carry out a lipid profile as part of an annual medical check or if there is specific concern about cardiovascular disease (CVD), especially coronary artery disease. They are tests that have been shown to be good indicators of whether someone is likely to have a heart attack or stroke caused by blockage of blood vessels or hardening of the arteries (atherosclerosis).^[2] The lipid profile typically includes:^[3]

- Total cholesterol
- High density lipoprotein cholesterol (HDL-C)—often referred to as good cholesterol
- Low density lipoprotein cholesterol (LDL-C)—often referred to as bad cholesterol
- Very low density lipoprotein cholesterol (VLDL-C)

The lipid profile report may include the ratio of cholesterol to HDL.^[3] This ratio is sometimes used in place of total blood cholesterol. The goal is to keep the ratio optimally at 3.5:1.^[4]

A lipid profile should be done after a nine- to twelve-hour fasting. If fasting is difficult to achieve, the values for total cholesterol and HDL-C may still be useful.^[5]

If total cholesterol is 200 mg/dl or higher or HDL-C is less than 40 mg/dl, the individual will require to have a follow-up lipoprotein profile to determine LDL-C and triglyceride levels.^[6] VLDL is a calculated number and not a typical measurement. It is estimated that VLDL equals 20% of total triglyceride levels, which is why triglycerides are divided by 5 to provide an estimated VLDL level.^[7]

Several studies have demonstrated changes in serum lipids in cancer patients. Studies in patients with many types of cancers have demonstrated an increase in serum triglyceride concentrations with disease progression, which may also be accompanied by a decrease in serum HDL cholesterol.^[8]

Breast cancer remains the most common type of cancer in females in the developed countries.^[9] It has been postulated that changes in the concentrations of serum lipids in breast cancer could result from increased production of tumor necrosis factor (TNF α) by activated macrophages in response to the tumor.^[10]

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Address for correspondence: Dr. Kamal Eldin Ahmed Abdelsalam, Division of Chemical Pathology, Faculty of Laboratory Medicine, Omdurman Ahlia University, P O Box: 786, Omdurman, Sudan. E-mail: kamaleldin55@yahoo.com

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Breast cancer occurs when cells in the breast tissue divide and grow without control. Physicians divide cancer into four main stages. Most physicians use the American Joint Committee on Cancer staging system.^[11]

Stage I breast cancer

The tumor is no more than 2 centimeters (cm), there are no cancer cells in the lymph nodes in the armpit, and the cancer has not spread anywhere else.

Stage II breast cancer

The lymph nodes under the arm contain cancer and the cancer has not spread and the lymph nodes under the arm contain cancer but the cancer has not spread.

In the stage 2A the tumor is less than 2 cm while in the stage 2B the tumor is between 2 and 5 cm.

Stage III breast cancer

Although no tumor is seen in the breast, the lymph nodes under the arm contain cancer cells and are stuck together or to other structures, but there is no sign of cancer spread. In the stage 3A, the tumor is more than 5 cm, in stage 3 B the tumor is fixed to the skin or chest wall, the lymph nodes may or may not contain cancer cells, but there is no further spread while in stage 3C, the tumor can be any size and has spread to lymph nodes in the armpit and under the breast bone, or to nodes above or below the collarbone, but there is no further spread.

Stage IV breast cancer

The tumor can be measured any size, the lymph nodes may or may not contain cancer cells, and the cancer has spread (metastasised) to other parts of the body such as the lungs, liver or bones.

The relationship between lipids and breast cancer is undistinguished. Until now, conflicting results have been reported on the association between lipids and risk of breast cancer in women. Some studies found that the dietary fat increases breast cancer risk. These studies have been strongly supported by international data collected among developed countries during the past few decades. Population aggregates with elevated lipid intake have tended to report elevated breast cancer incidence and mortality.^[12]

The major aim of this study is to examine the role of developing breast cancer in alterations in lipid profile in women.

MATERIALS AND METHODS

Serum was obtained from 60 normal healthy persons (control) and 120 patients with different stages of untreated breast cancer patients with clinical and histopathological evidence, from the out patients and hospital admissions admitted to the Radiation and Isotopes Center Khartoum (RICK) in period between January, 2008 and December, 2009. The patients and control groups were all females and were age matched. The sample size was calculated by using the formula:

$$N = z^2pq/d^2$$

Were N = sample size

z = the standard normal deviation (1.96) which corresponded to the level of 95% confidence level

p = proportion in target population

q = 1-p

d = degree of the accuracy desired

Many factors have been previously mentioned by many authors to influencing lipid profile in patients other than these with breast cancer were excluded from this study. These factors include diabetes mellitus, thyroid disorder, pregnancy, cardiac disease, obesity, alcohol abuse, renal diseases and other factors.^[7] Fasting 10 ml venous blood was drawn and serum was separated and analyzed within 6 hours at maximum. The lipid profile tests (T-C, HDL-C, LDL-C, VLDL, and T-C: HDL ratio) were analyzed in each sample.

The estimations were done using ready made enzymatic kits for cholesterol, triglyceride, and high density lipoprotein.^[13]

Very low density lipoprotein and low density lipoprotein results are obtained by Friedewald's equation^[14] in which:

$$VLDL = TG/5$$

$$LDL = T. Cholesterol - HDL - VLDL$$

Obtained data were analyzed by using independent sample *t*-test by Statistical Packages for Social Science Software (SPSS). Statistical analysis where the value of *P* < 0.05 is considered as significant and *P* < 0.01 as highly significant.

Table 1: Serum lipoproteins values during different stages of breast (mean ± SD)

Parameters	Control (N = 60)	Stage I (N = 52)	Stage II (N = 31)	Stage III (N = 20)	Stage IV (N = 17)	^a P value
T-C (mg/dl)	153.6 ± 1.5	278.2 ± 7.2*	277.4 ± 1.0*	280.5 ± 5.2*	277.1 ± 5.6*	0.09
HDL-C (mg/dl)	48.3 ± 4.1	50.5 ± 2.0	47.4 ± 1.4	50.5 ± 3.2	49.8 ± 1.9	0.12
LDL-C (mg/dl)	100.1 ± 2.2	195.7 ± 5.9*	194.9 ± 3.3*	189.6 ± 1.8*	190.9 ± 3.6*	0.08
VLDL (mg/dl)	37.7 ± 6.3	34.7 ± 12.1	37.3 ± 4.4	33.6 ± 2.9	39.5 ± 8.1	0.10
T-C:HDL ratio	3.2:1	5.9:1*	5.9:1*	5.6:1*	5.6:1*	0.09

*Significant change (*P* value < 0.05) when compared to the control, ^a Comparison of lipid profile and T-C: HDL-C ratio between stages results, N = number examined

Ethical clearance

This study was approved by the ethical committee of Radiation and Isotopes Center Khartoum (RICK) as a cross-sectional study. Informed consent was obtained from each participant.

RESULTS

The results showed that the values of T-C, LDL-C, and T-C/HDL-C ratio were significantly increased in all the four stages of breast cancer comparing to the control group. The values of HDL-C and VLDL were not affected. Lipid profile and T-C: HDL-C ratio showed insignificant variations when comparison was carried between stages results [Table 1].

The values of lipid profile and T-C: HDL-C ratios in relation to parity in breast cancer patients were insignificantly changed when compare the results between primiparity (one birth) and multiparity (2–5 birth) [Table 2].

The patients with breast cancer, in this study, were classified into three age groups. The values of lipid profile and T-C: HDL-C ratios were insignificantly changed when compare the results between these 3 groups [Table 3].

The patients with breast cancer (all cancer stages) were divided as premenopausal ladies and postmenopausal ladies. The values of lipid profile and T-C: HDL-C ratios were insignificantly changed when compare the results between the two groups [Table 4].

DISCUSSION

Getting breast cancer will undoubtedly change the patient life. Most women share a common fear: developing breast cancer. This is not an unfounded fear when considering that, except for lung cancer, breast cancer is the most common cancer found in women, accounting for one of every three

diagnoses.^[15] Cancerous tumors in the breast usually grow slowly. It is thought that by the time a tumor is large enough to be felt as a lump, it may have been growing for as long as 10 years. Early diagnosis is the best way to reduce the risk of dying from breast cancer.^[16]

In this study, as in Table 1, values of T-C, LDL-C, and T-C/HDL-C ratio were significantly increased in all the four stages of breast cancer (*P* value <0.05), while the values of HDL-C and VLDL were not significantly changed. These findings are in agreement with Florenza *et al.*^[17] and Michael *et al.*,^[18] but disagreed with Patricia *et al.*^[19] who found that HDL-C levels were significantly decreased, and also disagrees with Kiran *et al.*^[20] who found that TG results (and VLDL-C levels) were significantly increased especially in stage IV patients with breast cancer.

The increased T-C and LDL-C values and decreased HDL-C value increases the risk of coronary heart disease.^[21]

From the results and as demonstrated in Tables 2–4, all parameters (parity, age, and menopausal status respectively) showed insignificant effect on lipid profile. These findings were agreeing with those of Tornberg *et al.*^[22]

CONCLUSION

Lipid profile and T-C: HDL-C ratios were increased significantly in breast cancer in all stages.

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Table 2: Effect of parity in breast cancer patients on serum lipoproteins values (mean ± SD)

Parameters	Primiparity (N = 15)	Multiparity (N = 6)	P value
T-C (mg/dl)	279.3 ± 4.4	288.5 ± 3.3	0.05
HDL-C (mg/dl)	50.2 ± 2.7	54.8 ± 1.0	0.09
LDL-C (mg/dl)	189.1 ± 6.3	192.8 ± 3.1	0.11
VLDL (mg/dl)	35.7 ± 5.2	37.3 ± 1.6	0.08
T-C:HDL ratio	5.6:1	5.3:1	0.07

Table 4: Serum lipoproteins values of breast cancer patients during pre and postmenopausal status (mean ± SD)

Parameters	Premenopausal (N = 97)	Postmenopausal (N = 23)	P value
T-C (mg/dl)	283.7 ± 8.4	287.4 ± 3.5	0.05
HDL-C (mg/dl)	50 ± 2.7	52.8 ± 3.1	0.09
LDL-C (mg/dl)	193.1 ± 7.3	189.4 ± 4.6	0.11
VLDL (mg/dl)	33.3 ± 6.1	35.7 ± 3.9	0.08
T-C:HDL ratio	5.7:1	5.4:1	0.07

Table 3: Effect of age in breast cancer patients on serum lipoproteins values (mean ± SD)

Parameters	<30 Years (N = 75)	30-50 Years (N = 37)	>51 Years (N = 8)	P value
T-C (mg/dl)	278.3 ± 5.2	286.1 ± 7.0	288.5 ± 2.2	0.10
HDL-C (mg/dl)	49.3 ± 1.1	50.7 ± 1.8	50.1 ± 4.0	0.15
LDL-C (mg/dl)	195 ± 3.3	190.4 ± 2.7	187.9 ± 4.0	0.09
VLDL (mg/dl)	33.5 ± 9.1	31.8 ± 3.6	37.8 ± 2.4	0.08
T-C:HDL ratio	5.6:1	5.6:1	5.8:1	0.06

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