

FINAL REPORT

ASP/06/RE/MED/2013/30

Follow up study of Biochemical parameters of Sri Lankan breast cancer patients from selected centers - A comparison with normal healthy individuals.

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Nugegoda

2014 -2016

1. PROJECT DETAILS

1. **Reporting period:** Two years
2. **Name of the researcher:** Prof. Sagarika Ekanayake
3. **Project title:** Follow up study of Bio chemical parameters of Sri Lankan breast cancer patients from selected centers - A comparison with normal healthy individuals.
4. **Project duration:** 2 years
5. **Amount of grant approved:** Rs.958, 800.00
6. **Ref. No. and date of the letter of award:** ASP/06/RE/MED/2013/30
Date-12/12/2013
7. **Actual date of commencement of the project:** 1st of February 2014
8. **If the difference of time between (6) and (7) above is more than 6 weeks, reasons for the delay in commencement:**
This grant was requested with the intention of funding a currently ongoing study from another University grant (ASP/06/RE/MED/2013/20). Hence the actual date of initiation of the usage of the grant was started on 1st February 2014.
9. **Details of work done during the reporting period:**
 - 9.1 **Survey of literature relevant to the project:** completed
 - 9.2 **Names of research assistants engaged from to**
H.M Kasuni Akalanka 01/02/2014 01/01/2016
 - 9.3 **If the R/AA could not be engaged as undertaken, reasons for the failure:**
Not applicable

2. OBJECTIVES OF THE STUDY

General objective:

Follow up study of bio chemical parameters of Sri Lankan breast cancer patients from selected centers - A comparison with normal healthy individuals.

Specific objectives:

1. To study the antioxidant potential of serum in normal healthy 50 individuals as data on normal healthy individuals is not found in Sri Lanka
2. To conduct an interviewer administered questionnaire based study on an age matched control group, to compare the observed risk factors with normal healthy individuals.
3. To conduct a follow up study of certain biochemical parameters of patients in the study sample, who have undergone treatments. (surgery, chemotherapy or radiotherapy)
4. To further study the risk/causative factors of breast cancers from the patients who did not participate in the study sample and those who have already undergone surgery or treatments (radiotherapy or chemotherapy) by an interviewer administered same questionnaire based study.

3. ABSTRACT

Breast cancer (BC) is the commonest cancer among women in Sri Lanka and the incidence is increasing. Various biochemical parameters and risk factors are known to be associated with BC incidence but the exact etiology remains unexplained. Thus the study attempted to analyze selected biochemical parameters and risk factors of apparently healthy females, in order to compare the findings of a study with the same factors of newly diagnosed BC patients. Further a questionnaire based study was conducted to gather data on studied risk factors on BC patients already on treatment.

Consent obtained, age matched apparently healthy females (n=75) participated for the study. Serum lipid profile, serum LDH and uric acid concentrations, thyroid profile, serum ferritin, sex hormone concentrations were measured using biochemical and immune assays. Information on risk factors was gathered using interviewer administered questionnaire and anthropometric measures were taken by the researcher of apparently healthy females and breast cancer patients already on treatment (n=100, Ethical approval 28/14).

Average ages at menarche and menopause of apparently healthy females were 13 and 50 years respectively and were not significantly different when compared with BC women on treatment. Majority of BC and healthy women was married (98%) and has given birth to \geq one child and more than 85% of women has breast feed for more than one year. Among healthy using oral contraceptives for more than one year was observed among 17% and 83% of all has never experienced an abortion. However, the incidence was significantly high among BC women. None of the healthy women or BC women have used hormone replacement therapies. Mean BMI, waist circumference (WC), hip circumference (HC), waist to hip ratio (W:H) and mid upper arm circumference of apparently healthy women were 23.6 ± 2.5 kg/m², 80.0 ± 6.6 cm, 92 ± 7.2 cm, 0.87 ± 0.1 and 26 ± 2.7 cm respectively. Serum total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), triglyceride (TG) concentrations and TC: HDL-C of premenopausal healthy women were 178 ± 23 mg/dL, 111 ± 23 mg/dL, 44 ± 8.3 mg/dL, 108 ± 45 mg/dL and 4.2 ± 0.9 respectively and were not significantly different when compared to postmenopausal healthy women. Similarly TSH, T3, T4 concentrations were within the normal reference range.

Median (IQR) CRP of healthy females were 2.4(2.9) mg/L. Serum ferritin of premenopausal women were significantly lower when compared with postmenopausal healthy women. Mean uric acid, lactate de hydrogenase (LDH), HbA1c and cortisol concentrations were 257 ± 67 μ mol/L, 409 ± 104 IU/L, $4.62 \pm 1.05\%$ and 78.4 ± 35.0 ng/ml respectively.

In conclusion the incidence of abortions, usage of oral contraceptive were significantly high among breast cancer patients and age of menarche and menopause, parity, age at first child birth and duration of breast feeding was not significantly different among BC and healthy. Studied biochemical parameters of apparently healthy women were within the normal range though serum ferritin of premenopausal women was significantly low compared to postmenopausal women and was closer to the lower reference range.

4. INTRODUCTION

Breast Cancer is the most common cancer among Sri Lankan women and a higher proportion of younger females are affected compared to the other parts of the world¹. Many patients are detected at an advanced stage of the cancer² which lowers the years of survival. Hence a lot of money is spent on these patients could have been used for the national development. On the other hand late detection of a carcinoma will lower the mentality not only in the affected individual but also in the whole family, directly influencing on drawback of the development of the family and the society.

Even though it has been found that nutritional status³, biochemical and histopathological features affect breast cancers, comprehensive study is not done with respect to Sri Lankan breast cancer cases comparing and correlating all the above mentioned factors. Hence this will be the first study in Sri Lanka analyzing the biochemical and nutritional and other factors with women presenting breast cancers who have not undergone surgery.

Thus from this comprehensive study causative risk factors and nutritional status for breast cancer cases can be identified and suggestions can be made to improve the Sri Lankan life style to decrease the incidence. Also the study will facilitate in correlating the biochemical factors with histopathological features. If the outcome of the research is successful as anticipated early detection of breast cancers with high risk can be done so that the survival rate of the Sri Lankan breast cancer cases could be increased.

1. Mudduwa LKB, Mangalika SAM, Kohomban CJ, et al. Breast cancer screening; what age group should be targeted? *Galle Medical Journal* 2000;2(1):60-2
2. Rathnayake P, Madduwa LKB, Clinicopathological features of breast carcinoma
3. Ziegler RG. Vegetables, fruits, and carotenoids and the risk of cancer. *Am J Clin Nutr* 1991;53:2515-95.

5. LITERATURE REVIEW

According to the Ministry of Health, the crude breast cancer incidence is increasing since past decades and it is 19 per 100,000 population. This is the most common malignant tumor and the leading cause of carcinoma death in women and the incidence has been increasing during the past decades^{01,02,03}.

Several researches around the world have shown many causative factors of breast cancer. Studies on breast carcinomas in developed countries have shown that the incidence is very high in developed countries. But Japan remains an exception due to their better survival rates. This hints that the dietary intake and other geographic factors play a major role in breast carcinomas. This fact becomes clear when comparing this incidence with the Canadian National Breast Cancer Mammography Screening study which shows that the prognosis of post menopausal breast cancer patients were worsened by high saturated fat diets and were improved by beta carotene and vitamin C in the diet⁰⁴.

According to a study of 25,000 women, published in The New England Journal of Medicine, those who exercised at least four hours per week had a 37% lower risk of breast cancer.⁰⁵ Also it has been found that food-derived Heterocyclic amines act as etiologic agents in human mammary cancer⁰⁶. On the other hand it is found that western diets, alcohol, unnecessary exposure to radiation, family history, hormone levels (oestrogens and progesterone) and reproductive factors such as early puberty, menopause at old age, lack of children and lack of breast feeding⁰⁷ and obesity can open the doors to breast cancers. It has been found that induced abortion and oral contraceptive use were associated with increased risk of breast cancer. There occurs a statistically significant 40% increased risk of breast cancer following an abortion.⁰⁸

A study on nutritional features, biochemical factors and histopathological features of newly diagnosed breast cancer patients has been carried out with the financial support of ASP/06/RE/MED/2012/20 by the same team. Thus basically to compare the findings with apparently healthy females this grant has been utilized.

01. Cancer incidence data: Sri Lanka Year 2001 to 2005, National Cancer Control Programme; 2009
02. Kumari P B V R, Goonewardena C S E. Delay among women reporting symptoms of Breast cancer Journal of the College of Community Physicians of Sri Lanka(*PP21-27*) Vol 16, No 1, June 2011
03. <http://www.slideshare.net/theimho/jayakumar-presentation> (accessed on 12/ 05/ 14)
04. Ziegler RG. Vegetables, fruits, and carotenoids and the risk of cancer. *Am J Clin Nutr* 1991;53:2515-95.
05. Kushi LH, Byers T, Doyle C, et al. American Cancer Society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin* 2006;56:254-281.
06. Elizabeth G. Snyderwine, Food-derived Heterocyclic Amines as Etiologic Agents in Human Mammary Cancer: Conference on Breast Cancer Research: Atlanta, Georgia, April 25-28, 1993.
07. De Silva M, Senarath U, Gunatilake 4.M, Lokuhetty D. Prolonged breastfeeding reduces risk of breast cancer in Sri Lankan women: a case-control study. *Cancer Epidemiol* 2010;34(3):267-73.
08. M, Lokuhetty D. Prolonged breastfeeding reduces risk of breast cancer in Sri Lankan women: a case-control study. *Cancer Epidemiol* 2010;34(3):267-73.

6. METHODS AND MATERIALS

Experimental design:

Sample size: 75 apparently healthy age matched females and 100 BC patients already on treatment participated in the study

Place of study: Dept of Biochemistry /FMS/USJP

Methodology:

Research methodologies

Specific objective 01: To study the antioxidant potential of serum in normal healthy ⁵⁰ individuals as data on normal healthy individuals is not found in ^{Sri Lanka}

Serum antioxidant potential of ⁷⁵ apparently healthy ~~75~~ females was measured using ABTS free radical scavenging assay on the same day of blood withdrawal using a spectrophotometer.

Specific objective 02: To conduct an interviewer ^{viewer} administered questionnaire based study on an age matched control group, to compare the observed risk factors with normal healthy individuals.

- Apparently healthy age matched females (n=75) were selected for the study.
- Data on nutritional status, age of menarche, age of menopause, marital status, number of children, duration of breast feeding, usage of oral contraceptives, number of abortions, involvement of exercises was collected using an interviewer administered questionnaire.

Following anthropometric measurements of apparently healthy females were taken

- Weight, Height, Waist circumference, Hip circumference, Mid arm circumference, Chest circumference

Serum lipid profile and lactate dehydrogenase concentrations, uric acid, oestradiol II, progesterone and testosterone of apparently healthy women were measured using biochemical analyzer Konelab 20XT and mini vidas immune analyzer.

Specific objective 03: To conduct a follow up study of certain biochemical parameters of patients in the study sample, who have undergone treatments. (surgery, chemotherapy or radiotherapy)

- ~~Consent obtained~~ Breast cancer patients ^{whose consent was obtained and who} ~~those who have~~ underwent treatment and ~~who~~ participated in the ongoing study were selected.
- A blood sample was drawn to study the serum total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol, very low density lipoprotein cholesterol, triglyceride concentrations and total antioxidant potential were measured

Specific objective 04: To further study the risk/causative factors of breast cancers from the patients who did not participate in the study sample and those who have already undergone surgery or treatments (radiotherapy or chemotherapy) by an interviewer ^{viewer} administered same questionnaire based study. ^{undergone}

- Breast cancer patients (n=50) who have ~~underwent~~ ^{undergone} treatment for breast cancer and those who did not participate in the study sample were selected.
- Data on nutritional status, age of menarche, age of menopause, marital status, number of children, duration of breast feeding, usage of oral contraceptives, number of abortions, involvement of exercises was collected using an interviewer administered questionnaire.

Following anthropometric measurements of breast cancer patients were taken

- Weight, Height, Waist circumference, Hip circumference, Mid arm circumference.

12. Analytical methods used:

12.1 Quantitative techniques used:

Biochemical parameters studied were analyzed using auto analyzer, immuno analyzer and spectrophotometer.

12.2 Qualitative techniques used:

Qualitative data was collected using an interviewer administered questionnaire.

12.3 Other techniques used: Not applicable.

7. RESULTS

Information collected on interviewer administered questionnaire of breast cancer and apparently healthy women is illustrated in table 01.

Table 01: Data on reproductive history of breast cancer and healthy women

		Women with breast cancer		Apparently healthy females (n=75)	
Mean age of menarche (years)		13± 1.5 ^a		13± 1.5 ^a	
Mean age of menopause (years)		49± 3 ^b		50 ±3 ^b	
Parity	Nullparious	n=13 (5%) ^c		n=1 (1%) ^c	
	Mean number of children	2±1 ^d		2±1 ^d	
Mean age at first child birth		27±6 ^e		29±3.5 ^e	
		Incidence	%	Incidence	%
Using hormonal contraceptives	<1 year	7	2.7 ^f	8	10 ^g
	>1 year	87	34 ^h	13	17 ⁱ
Duration of breast feeding	<1 year	25	10 ^j	11	14.6 ^k
	1-2year	72	28 ^l	30	40 ^m
	>2 years	158	62 ^o	34	45.4 ^p
Incidence of abortions	0	154	60 ^q	62	83 ^r
	1	61	24 ^s	7	9 ^t
	2	38	15 ^u	6	8 ^v
	3	2	1	0	0
Incidence of hormone replacement therapy		0	0	0	0

Different superscripts along a row indicate significant differences at 95% confidence interval

Anthropometric parameters of healthy women are listed in Table 02.

Table 02: Anthropometric parameters of healthy women

Parameters	Healthy females (n= 75)
Weight (kg)	54 ± 7 ^a
Height (m)	1.51 ± 0.1 ^b
BMI (kg/m ²)	23.6 ± 2.5 ^d
WC (cm)	80.0 ± 6.6 ^f
HC (cm)	92 ± 7.2 ^g
W:H ratio	0.87 ± 0.1 ⁱ
MAC (cm)	26 ± 2.7 ⁱ

Serum antioxidant capacity of apparently healthy women is illustrated in table 03.

Table 03 Serum antioxidant potential of apparently healthy women

Total antioxidant capacity in Trolox equivalents	
Premenopausal(n=35)	6.1(±1.0) ^a
Postmenopausal (n=40)	6.1(±1.0) ^a
All (n=75)	6.1(± 1.3) ^a

Serum total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), very low density lipoprotein cholesterol (VLDL-C), triglyceride(TG) and TC:HDL-C ratio of lipid profile of apparently healthy females is illustrated in Table 04.

Table 04: Lipid profile of healthy females.

Test (Reference range- mg/dL)	Healthy females (n= 75)	
	Premenopausal n=30	Postmenopausal n=45
¹ TC (< 200)	178±23 ^b	194±19 ^b
¹ LDL-C (< 100)	111±23 ^d	114±23 ^d
¹ HDL-C (> 40)	44±8.3 ^e	45±7.2 ^e
¹ TG (<150)	108±45 ^f	123±13 ^f
¹ TC:HDL-C (< 5)	4.2±0.9 ^h	4.2±0.7 ^h

Different superscripts along a row indicate significant differences at 95% confidence interval

CRP, UA, LDH, HbA1C, ferritin, cortisol and vitamin D concentrations of age matched apparently healthy females are illustrated in Table 05.

Table 05: Selected biochemical measures among apparently healthy women

Test (Reference range)	Healthy females (n=75)	
¹ CRP (< 6 mg/L)	Pre	2.2(1.8) ^b
	Post	2.5(2.3) ^b
	All	2.4(2.9) ^b
¹ UA (Female 160- 340µmol/L)	Pre	232 ±87 ^d
	Post	247 ± 41 ^d
	All	257 ± 67 ^d
² LDH (IU/L) (200-400)	Pre	404 ± 67 ^e
	Post	389 ± 124 ^f
	All	409 ± 104 ^e
¹ HbA1c(%) (<6.5)	Pre	4.52±1.52 ^h
	Post	4.76± 0.60 ^h
	All	4.62± 1.05 ^h
¹ Ferritin (ng/mL)	Pre	26.1(28.1) ^j

(10-120)	Post	45.00(51.2) ^k
² Vitamin D (ng/mL)	Pre	20.3± 4.4 ^l
(9.3-48.5)	Post	20.1± 4.21 ^l
	All	20.2 ±4.3 ^l
² Cortisol (ng/mL)	Pre	70.9± 31.7 ⁿ
8-10 am(54.9-287.5)	Post	85.1± 37.3 ⁿ
	All	78.4±35.0 ⁿ

Different superscripts along a row indicate significant differences at 95% confidence interval; ^lManual on Standard operation procedure, sample collection and reference range for clinical chemistry, World health Organization, Ministry of Health and the Department of Biochemistry, Medical Research Institute, Sri Lanka. ² Reference range given by the respective kit (VIDAS)

The mean serum TSH, T3 and T4 concentrations of age matched apparently healthy females are given in Table 06.

Table 06: Thyroid profile of breast cancer patients and healthy females

Test		Apparently healthy females (n=75)	Reference ranges ¹
TSH3 (mIU/L)	Premenopausal	3.31±1.98 ^a	0.4-4.5
	Postmenopausal	3.03±2.65 ^a	
	All	3.19± 2.65 ^a	
FT3 (pg/mL)	Premenopausal	2.47±0.47 ^c	2.08-6.74
	Postmenopausal	2.32±0.43 ^c	
	All	2.35± 0.33 ^c	
FT4 (ng/dL)	Premenopausal	1.00± 0.37 ^f	0.8 -2.3
	Postmenopausal	0.97±0.41 ^f	
	All	0.99 ± 0.25 ^f	

Different superscripts in each row indicate significant differences (p<0.05) among hormones at each phase among breast cancer and apparently healthy females

TSH3- serum thyroid stimulating hormone 3rd generation; FT3- serum free triiodothyronine; FT4- serum free tetraiodothyronine; ¹Manual on Standard operation procedure, sample collection and reference range for clinical chemistry, World Health Organization, Ministry of Health and the Department of Biochemistry, Medical Research Institute, Sri Lanka.

Serum sex hormone concentrations of premenopausal healthy women (n=30) and postmenopausal and healthy women (n=45) are illustrated in Table 07.

Table 07- Sex hormone concentrations of apparently healthy women

Sex Hormone		Healthy females
¹ Oestrogen (pg/mL)	Follicular phase(18-147)	145.54(124) ^a
	Ovulation phase (93-575)	106.00(102) ^a
	Luteal phase (43-214)	93.36(47.28) ^a
	Postmenopausal (<58)	17.81(29.96) ^b
¹ Progesterone (ng/mL)	Follicular phase(≤0.25-0.54)	0.47(0.45) ^c
	Ovulation phase (≤0.25- 6.22)	5.48(14.7) ^c
	Luteal phase (1.5-20)	5.20(9.73) ^c
	Postmenopausal<0.41	0.24(0.18) ^d
² Testosterone 0.1-0.5 ng/mL	Premenopausal	0.39(0.46) ^f
	Postmenopausal	0.21(0.22) ^f

Different superscripts in each row indicate the significant differences (p<0.05) among hormones at each phase among breast cancer and apparently healthy females. ¹ Reference range given by the respective kit (VIDAS). ²Manual on Standard operation procedure, sample collection and reference range for clinical chemistry, World Health Organization, Ministry of Health and the Department of Biochemistry, Medical Research Institute, Sri Lanka.

The median CA15-3(IQR) of apparently healthy women (n=35) in the study sample was 14.19 (7.09) U/mL.

8. DISCUSSION

Mean age of menarche and menopause, number of children, age at first child birth and duration of breast feeding were not significantly different among breast cancer and healthy women thus cannot be considered as risk factors among present study sample. However usage of oral contraceptives and having one or more abortions were common among breast cancer patients than apparently healthy.

Apparently healthy females had their BMI, WC, HC, W: H ratio and mid upper arm circumference within the reference ranges according to WHO Asian pacific guidelines. Serum antioxidant capacity of apparently healthy premenopausal women was not significantly different when compared to postmenopausal women. Considering the biochemical parameters studied TC, HDL-C, LDL-C, TG, TSH, T3, T4, LDH, CRP, cortisol, uric acid and serum vitamin D of healthy women were within the reference ranges. Even though serum ferritin was within the reference range premenopausal women had significantly lower levels of ferritin when compared to postmenopausal women. Sex hormone profile was also within the given reference ranges.

A pilot follow up study of biochemical parameters of BC women after treatment indicated that upon awareness of elevated serum biochemical measures, patients had taken necessary dietary and medicinal management. Thus results of follow up study were biased and was not solely due to breast cancer. Thus instead of that objective, a new objective of a statistical model development was executed combining results of the study financially supported from ASP/06/RE/MED/2012/20. According to the model among all the risk factors, having lower serum uric acid and testosterone, having elevated LDL-C and HbA1c were found to be risk factors.

9. PUBLICATIONS AND COMMUNICATIONS

Communications:

Local

1. H.M.K Akalanka, S Ekanayake;(2015) Serum uric acid: a marker to predict risk of breast cancer? 71st Annual sessions of Sri Lankan Association for the Advancement of Science: page 104
2. H.M.K Akalanka, S Ekanayake, K Samarasinghe;(2015) Association of anthropometric parameters and lipid profiles of newly diagnosed breast cancer patients: Annual Scientific Sessions of menopause society of Sri Lanka: Page 27 **(1st place in free paper session)**
3. H.M.K Akalanka, S Ekanayake, K Samarasinghe;(2016) Vitamin D status of newly diagnosed breast cancer patients: Annual Scientific Sessions-Nutrition Society of Sri Lanka: Page 18,19
4. H.M.K Akalanka, S Ekanayake K Samarasinghe;(2016) A comparative study of thyroid profiles of breast cancer patients and apparently healthy women ,5th Young Scientists forum symposium :Page 05-07 **-Merit award**

International

1. H.M.K Akalanka, S Ekanayake, K Samarasinghe,(2014) A study on risk factors associated with development of breast cancer, Indo global health care summit and expo 2014.
2. H.M.K Akalanka, S Ekanayake, K Samarasinghe.(2015), A study of selected risk factors in Sri Lankan breast cancers., 2nd Ruhuna International Science and Technology conference: page 90
3. H.M.K Akalanka, S Ekanayake, K Samarasinghe.(2015), Serum lipid profiles of newly diagnosed breast cancer patients, accepted to 12th Asian Congress of Nutrition, Yokohama,Japan:Page 123 **(Urakami Foundation travel award)**.
4. H.M.K Akalanka, S Ekanayake, K Samarasinghe.(2015),Can sex hormone concentrations predict Her2 status of postmenopausal breast cancer patients, 8th International Research Conference, General Sir Hohn Kotelawala Defense Academy page 131 **(Best paper award)**
5. H.M.K Akalanka, S Ekanayake, K Samarasinghe.(2016), Serum ferritin in newly diagnosed breast cancer and apparently healthy individuals, submitted to International Scientific Conference, Faculty of Medicine, Ragama

6. H.M.K Akalanka, S Ekanayake, K Samarasinghe.(2016), CA15-3 and the grade of the breast carcinoma in newly diagnosed patients submitted to International Scientific Conference, Faculty of Medicine, Ragama.

Manuscripts in preparation:

1. H.M.K Akalanka, S Ekanayake, K Samarasinghe Serum lipid profiles and anthropometric measures of newly diagnosed Sri Lankan breast cancer patients
2. H.M.K Akalanka, S Ekanayake, K Samarasinghe Serum sex hormone concentrations of postmenopausal breast cancer patients.

10. BUDGET

Value of the grant - Rs.747,800.00	
Cost component	Total expenditure incurred (Rs.)
Payment for R/AA	458, 929.86
Chemicals and consumables	499, 870.14
Committed for equipments	-
Cash Advance {Travelling of R/AA Stationeries, incentives, syringes, Photocopying/ Roneo work etc}	-
Travelling of the principal investigator	-
Travelling of other researchers	-
Subsistence of other researchers	-
Typing	-
TOTAL	958,800.00

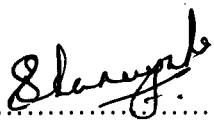
11. ACKNOWLEDGEMENT

I wish to gratefully acknowledge the research committee of University of Sri Jayewardenepura for selecting the project to award the grant which has been well utilized. In addition the staff of finance divisions of Faculty of Graduate Studies and Faculty of Medical sciences is gratefully acknowledged for the support they have extended in numerous ways which has contributed to the success of this project.

The funds have been used in postgraduate training of H.M Kasuni Akalanka (PhD) and generating information with regard to Biochemical parameters features of newly diagnosed breast cancer patients from selected centers. The research has helped produce many abstracts and some work has already been published and accepted to be published.

05th February 2016

Date:


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Signature:

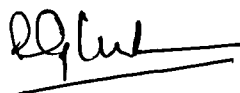
Observations of the Head of the Department

Project has been completed and Ms. HMK
Akalantha has submitted her PhD thesis for registration.
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Department of Biochemistry
Faculty of Medical Sciences
University of Sri Jayewardenepura
Gangodawila, Nugegoda
Sri Lanka.

Observations/ recommendation of the Dean

Recorded. Several publications have
come out of the project.
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Date : 12/02/2016

Signature: 

Chairperson / Faculty of Medical Sciences Research
Centre