Prevalence of Breast Cancer Among ABO Blood Group Subjects in Niger Delta Communities in Nigeria: A Public Health Risk

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Abstract

There has been increasingly conflicting reports with the correlation of ABO blood groups and breast cancer incidence though none has been able to prove the existence of the casual relationship. However, some studies have reported no association between breast cancer development and blood group indices; whereas, others have reported a high incidence of breast cancer among ABO blood groups. This study was aimed at ascertaining the prevalence of breast cancer incidence among ABO blood group subjects; and establishing the relative distribution of ABO blood group antigens as well as the relationship between ABO blood group and breast cancer development. The researchers recruited a total of eighty participants for breast cancer patients and control subjects in an equal proportion. A cross-sectional study design approach was explored; hence, participants were randomly selected in some Health facilities within the Niger Delta region (South-South Nigeria). Laboratory investigation assay performed includes ABO blood grouping methods (cell and serum) hence, both tile and tube methods were explored to increase precision and accuracy of results. SPSS version 21 statistical package was used to analyse the data. The results revealed a comparable ABO blood groups distributions for both the breast cancer patients {08 (20%); 02 (5%); 02 (5%) and 28 (70%)} and control subjects {09 (22.25%); 06 (15%); 03 (7.5%) and 22 (55%)} respectively. Chi Square Distribution; $X^2(1)= 1.920$; P-value = 0.166, not statistically significant. Also, the result of the risk estimates showed odd ratio (OR = 0.524±0.209) and relative risks (Cohort A: RR= 0.714±0.432, 1.181 and Cohort B: RR= 1.364±0.889, 2.092) respectively. The report from this study uncovered that blood group O is more prevalent in this region. This study further revealed no evidence of significant difference (P>0.05) between ABO blood groups of breast cancer patient and the control subjects. In addition, no relationship between breast cancer disease and ABO blood group indices; on

the other hand, there is a link between blood group antigens and risk of breast cancer development. However, it is strongly suggested that ethnic and racial distribution as well environmental factors should be put into consideration while ascertaining the population at risk in a given period.

Keywords: ABO blood group, Breast Cancer, Public Health, Niger Delta, Health Risk, Regular screening

Introduction

The blood group is a vital genetic marker that can easily be assayed in an individual. ABO blood group genes are mapped at chromosome 9 band q 34.2 region; this encodes glycosyltransferases that catalyze the transfer of nucleotide donor sugars to the H antigen to form the ABO blood group antigens (Yazer, 2005). It is believed that, this forms the basis in which genetic variations are common in many cancer patients as reported by Yazer, 2005 and Kamlesh *et al.,* 2005. Blood group carbohydrates expressed on cell surface of metastatic cancer cells function as cell adhesion molecules hence supports the correspondence between blood groups and malignant tumors, due to the expression of these blood group antigens on the surface of malignant cells (Kamlesh *et al.,* 2005). Nonetheless, Acid and colleagues (1953) demonstrated a relationship between stomach cancer and ABO blood group; this was probably the first study which showed that a relationship exist between blood group A and gastric cancer development. Other studies have also reported the association between blood groups and the risk of cancer development such as high incidence of blood group A implicated in various cancer cases (Beardmore *et al.,* 1983; Henderson *et al.,* 1993). Furthermore, Henderson *et al* (1993) also reported the risk of ovarian cancer among blood group A individuals; whereas, others study also revealed higher incidence of cancer cases among blood group O individuals as seen in the work of Karakousis *et al* (2006); hence, blood group O individual was reported to have recorded high incidence of skin cancer than others.

The ABO blood group distribution varies in different geographical, ethnic and socio-economic groups according to an England based study in the early eighties (Beardmore *et al.,* 1983). The distribution of ABO blood groups in Nigeria have been reported by some studies similarly stating that blood group O have the highest frequency, followed by blood group A, next to it is blood group B and blood group AB been the least distributed within the Nigerian population from previous studies undertaken across the six geopolitical zones (Johnson *et al.,* 2014; Falusi, *et al* 2000; Nwauche & Ejele 2004; Akinnuga *et al.,* 2011), including the south-south (Nigeria) region of Niger Delta where this present study was carried out (Nwauche & Ejele 2004). The variation in the distribution of ABO blood group phenotypes based on geographical location, genetic inheritance, ethnic and socio-economic group factors thus, these factors must be placed into consideration while conducting a research in this direction and also while planning for prevention and management strategies of this huge public health issue with lot of cofounding health, social and economic consequences (Beardmore *et al.,* 1983; Johnson *et al.,* 2014; Falusi, *et al* 2000; Nwauche & Ejele 2004).

It is loosely suggested that the cause of breast cancer is multi-factorial, especially with recent studies on the divers predisposing factors. However, the issue of hereditary cannot be ignored as this has been traced as a strong indicator in the formation of cancerous cells and several cancer studies have shown the role of genetic factors in the development of cancer (Surekha *et al.*, 2004). ABO blood type is an inherited trait and previous studies have observed a combination of a relationship in one hand as well as null relationship between ABO blood group and the development of certain malignancies, including breast cancer (Karakousis *et al.,* 2006;Surekha*et al.*, 2004; Yazer, 2005; Kamlesh *et al.,* 2005). There are several conflicting reports about the relationship between ABO blood groups and breast cancer though none has been able to prove the existence of a causal relationship. However, Jayant (2007) reported that there was no existing association between breast cancer and blood group whereas; other scholars have reported a high incidence of breast cancer in ABO blood group. It was also reported that, blood group B have high incidence of breast cancer according to Surekha *et al* (2004) in a bid to explain the involvement of esterase D and ABO blood group in breast cancer disease development (Surekha *et al.*, 2004). Nevertheless, an elevated rate of blood type A as compared to controls has been reported in breast cancer patients (Anderson, 2004). Furthermore, a study showed that the presence of A-antigen is linked to the risk of developing breast cancer. On the other hand, other studies observed no correlation with ABO blood group (Dede *et al.,* 2010).

In Niger Delta communities with high level of oil and gas activities and huge environmental problems, there seems to be paucity of data with respect to the association and development of cancer among ABO blood group subjects hence, the study would attempt to ascertain the prevalence of cancer among ABO blood groups and possibly their association among the screened population. It is believed that data generated would help to plan for further health intervention strategy on how to manage the risk factors and the prevention of the disease in general especially in environmentally polluted Niger Delta communities were access to robust Health care facilities still remains a huge challenge till date

Experimental Design

The cross sectional study was conducted among breast cancer patients assessing care in selected Health care facilities in Niger Delta region (South-south Nigeria). A total of eighty participants were randomly selected and recruited for the study in an equal ratio of 1:1 for both test subjects (breast cancer patients) and control subjects.

Study Location

There are about 250 local dialects among Niger Delta oil producing communities of South- South part of Nigeria. However, Port Harcourt is the headquarter of all the oil producing states which consist of eight states namely Ondo, Rivers, Delta, Abia, Akwa-Ibom, Cross River, Edo, Imo and Bayalsa state with about 31 million people respectively. More so, it also consist of about 40 ethnic groups namely the Ibibio, Etcheian, Igbo, Annang, Oron, Ijaw, Itsekiri, Yoruba, Isoko, Urrhobo, Kalabari, Esan, Bini, Ogoni and Efik (Azuonwu *et al.*, 2015) It extends over about 70,000 km^2

(27,000 sq mi) and occupies about 7.5% of Nigeria's land mass in size. It is densely populated given myriad of industrial activities that are massive in the region especially in oil and gas sector. It produces about 2 million barrels (320,000 m^3) of oil a day. These have continually triggered an unprecedented environmental threat to the inhabitants of oil producing communities till date without any hope or plan of environmental remediation by the major actors.

Inclusion Criteria: All subjects recruited for this study were willing to participate; female volunteer control subjects negative for breast cancer screening were included. All subjects were above 20years and resident in the Niger Delta communities.

Exclusion Criteria: All men were excluded from the study. Females less than 20 years of age as well as female individuals who did not consent to be involved were removed.

Methodology

Laboratory diagnosis includes ABO blood grouping, here a combination of cell and serum grouping were explored in this study. Sample collection was performed with the use of a tourniquet tightly tied on the subject's arm and a blood drawn with a 4ml syringe, which was aseptically transferred into an EDTA sample bottle (2ml) and plain bottle (2ml) for cell and serum grouping respectively. The cells were washed 3-5times and the washed cells were used for the blood grouping assay, using the PK7300 Blood Grouping Analyzer (Beckman Coulter), a fully automated blood grouping analyzer which uses the proven system of haemagglutination in patented terraced micro-plates to carry out blood grouping.

Statistical analysis

The SPSS statistical package version 21 was used for analysis. Statistical analysis involved comparison between groups. Frequency distribution was obtained and Chi square was used to analyze categorical data to show association respectively. Also, risk estimates (odd ratio) were obtained statistically.

Ethical Consideration

Ethical authorization for this study was sought from the ethical committees of Department of Medical Laboratory Science, Rivers State University of Science and Technology. Informed written consents were obtained from the subjects after a detailed information of the aim of the study procedure were explained to them and they consented by endorsing on the consent form. Participants data were both primary and secondary from their folders; the questionnaire captured ABO blood groups which were self-reported by the participants also, the ABO blood groups result were available on their folders. However, for the purpose of this study blood grouping assay was performed on all study participants thus, confirming what was obtained from the folders and self-reports made by the participants. The participants consent-

ed to be recruited into the study as well as the medical procedure of blood sample collection which was used for their ABO phenotyping.

Limitation of the study

The breast cancer patients were not much as at the time the study was carried out, so the sample size were only restricted to the number of patients available. Short study time duration was another limitation on the study. The irregularity in the hospitals functioning capacity (strike) as well, also affected the study hugely. The study was only limited to those within the River State of Niger Delta communities.

Results

The relative distribution of breast cancer among ABO blood group as shown in this study can be seen in table 1. The ABO blood groups were comparable for both the breast cancer patients {08 (20%); 02 (5%); 02 (5%) and 28 (70%)} and control sub-jects {09 (22.25%); 06 (15%); 03 (7.5%) and 22 (55%)}. In this study blood groups O> A> B> AB had a decreasing order of ABO distribution.

Table 1: Prevalence of Breast Cancer among ABO Blood Group

	Blood Group A	**Blood Group B**	**Blood Group AB**	**Blood Group O**	**Total**
Breast Cancer Patients	08 (20%)	02 (5%)	02 (5%)	28 (70%)	40 (100%)
Control	09 (22.25%)	06 (15%)	03 (7.5%)	22 (55%)	40 (100%)
N	17 (21.25%)	08 (10%)	05 (6.25%)	50 (62.50%)	80 (100%)

Risk estimate (Odd Ratio)

Risk estimates of odd ratio was extrapolated in this study; thus, the study reports odd ratio (OR = 0.524±0.209) of ABO blood groups with antigens combined (All Blood Groups A, B, and AB) to those without ABO blood groups antigens as reported in table 2.This means that the odd of having breast cancer in these blood groups is 0.524 times higher in the ABO blood groups with antigens (groups A, B, &AB) than in blood group O (i.e. group without antigen). However, this was not observed when each of the blood groups were risk estimated separately rather it showed no evidence in the risk of developing breast cancer amongst the different ABO blood groups.

Table 2

*Risk Estimate (*odd ratio) of ABO Blood Groups among Breast Cancer patients and Control subjects

Variable	Odd Ratio	95% Confidence Interval	
		Lower	Upper
ABO Groups with Antigens (Group A,B&AB)/ Without Antigen (Group O)	0.524	0.209	1.314

Note. Table2 showing odd ratio of ABO Blood Groups among Breast Cancer patients and Control subjects (OR = 0.524±0.209).

Table3 shows ABO Blood Groups, which were categorically, analyzed using a statistical test (chi square) with p- value set at the 0.05 significance level. Chi Square Distribution; $X^2(1) = 1.920$; P-value = 0.166, not statistically significant etc. The Chi Square result of $X^2(1) = 1.920$; P-value = 0.166 shows no significance; this means that there is no statistical significance between ABO blood groups amongst the breast cancer patient and the control subjects thus, the null hypothesis of no difference is retained as initially hypothesized.

Table 3: Chi-Square Distribution of ABO Blood Group and Breast Cancer

	Value	df	P-value (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.920	1	.166		
Continuity Correction	1.333	1	.248		
Likelihood Ratio	1.930	1	.165		
Fisher's Exact Test				0.248	0.124
Linear-by-Linear Association	1.896	1	.169		
N	80				

Bar Chart: Distribution of ABO Blood Groups among Breast Cancer Patients
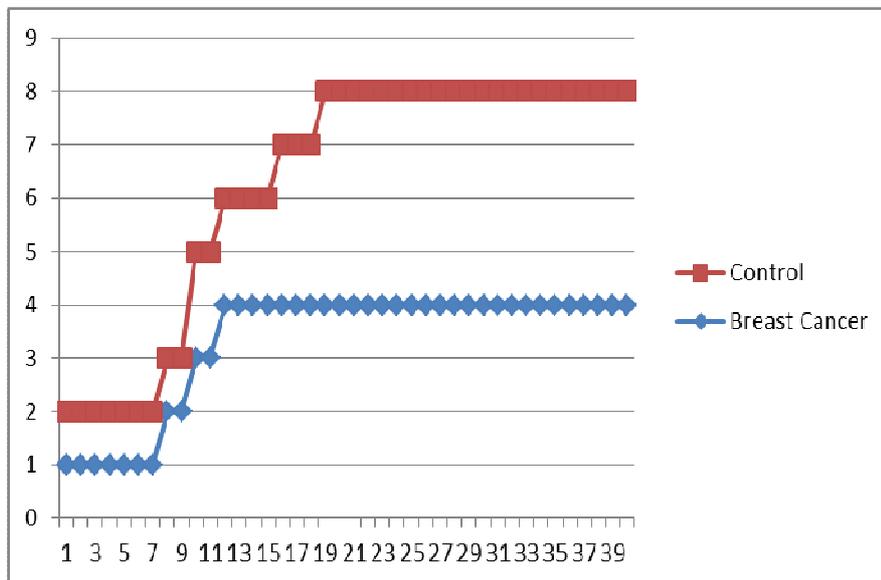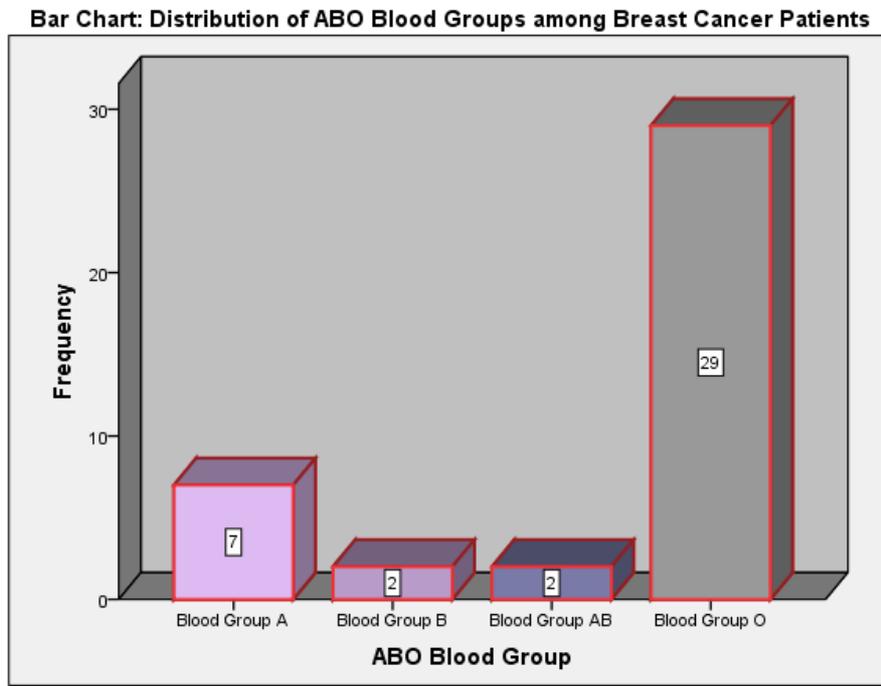

Fig 2.0. Frequency Distribution of ABO Blood Group among Breast Cancer Patients and Control Subjects

Discussion

The relative distribution of breast cancer among ABO blood group as contained in this study showed that the ABO blood groups were comparable for both the breast cancer patients and control subjects. Blood groups AB, B, A and O frequencies were reported in an increasing order of distribution in this study, with blood group AB been the least and blood group O been reported to have the highest frequency distribution in the study population as revealed by this present study, this is in conformity with previous studies done in Nigeria (Johnson *et al.,* 2014; Falusi, et *al* 2000; Nwauche & Ejele 2004; Akinnuga *et al.,* 2011). Factors that may be implicated for the comparability of the distribution of ABO blood group phenotypes in both the breast cancer patients and control subjects could probably be similarities in geographical location, genetic inheritance, ethnic and socio-economic group factors which are likely to differ in another populace and setting as reported by some scholars (Beardmore *et al.,* 1983; Johnson *et al.,* 2014; Falusi *et al.,* 2000; Nwauche & Ejele 2004). These factors underpinned a strong reason for considerations which should be double checked and analyse holistically when making policy choices anchoring on planning and management strategies of public health interest.

A large Indian based study on "*Relationship between various cancers and ABO blood groups – A Northern India Experience" by* Akhtar, and colleagues (2010) reported a contrary ABO distribution with blood groups B, A, O and AB in a decreasing frequency respectively. According to the study, frequency of blood group A was significantly higher and O group was significantly lower in cancer patients as compared to controls whereas, the incidence of A blood group was significantly higher in breast and lung cancer patients (Akhtar *et al.,* 2010). In addition, high frequency of blood group A and low frequency of AB blood type had been observed in breast cancer patients. Same trend was also reported by previous studies (Guleria *et al.,* 2005; Mourali *et al.,* 1980).This however, is also in line with the present study that AB had low frequency distribution as well but not peculiar to breast cancer patient but in the general study population including the control. The reason for this is obscure however, the ABO distribution could be attributed to racial distribution as the predominant blood group in this region is blood group O whereas AB is a rare blood group in this part of the world.

The relationship between breast cancer and the ABO blood phenotypes had different degrees in various studies; this study revealed no evidence of significant difference between ABO blood groups of breast cancer patients with the control subjects as well as non-existence of an association between breast cancer disease risk and ABO blood groups in isolation. This is in agreement with results obtained from the previous study performed by Manzarovu *et al.,* (1986) which reported no relationship between the blood groups and breast cancer. Nevertheless, the report from this study showed that blood group O is more prevalent in this region and though there is no evidence of relationship between ABO blood groups singly (i.e. either groups A or B or AB or O) and risk of breast cancer within this study population; nonetheless contrary to some previous studies. This could however, be linked to the fact that the frequencies of blood groups A, B and AB are small in this present study, the majority of the study population here are blood group O individuals and it is

known that blood group O possess an inherent protection against breast cancer as oppose to blood group A (Karakousis *et al.,* 2004; Surekha *et al*., 2004; Yazer, 2005; Kamlesh *et al.,* 2005). In addition, breast cancer shows a weak or no association in non-secretors and the secretor status was not determined in this study. On the other hand, when groups A, B and AB were pooled together and categorized as ABO blood groups with antigens (non group O) against the group O (those without antigens) it was risk estimated to 52% chances of developing breast cancer among the ABO groups with antigens (groups A, B &AB) otherwise known as non-group O compared to those without antigen (group O). This is similar to other studies which support the significant relationships between the blood type and breast cancer risk (Stamatakos *et al.,* 2009). Tryggvadottir *et al., (*1988) in an Iceland study on Familial and sporadic breast cancer cases within the coast who reported a comparison related to ABO blood groups and risk of bilateral breast cancer. In the same view, a case control study in Uruguay considered blood group as one of the risk factor to breast cancer development according to Ronco *et al.,* (2009). Furthermore, Jakoubkova and colleagues (1965) reported that there is a link between breast cancer development and blood group in the mid-nineties. Some other studies account positive involvements between type A and risk of breast carcinoma (Rai *et al.,* 1970; Munzarová *et al.,* 1985).In addition, positive associations exist with type A or B among women with a family history of breast cancer (Anderson, 2004). Several studies have reported an increased risk in the development of breast cancer in blood group A individuals than other ABO blood groups. Besides a study performed by Guleria *et al.,* (2005) showed that group A was significantly linked with breast cancinoma. The mechanism behind blood group A been at risk for breast cancer is unclear as some scholars attributed it to increased resistance to apoptosis and facilitate escape from immune control (Marionneau *et al.,* 2002). Furthermore, modified expression of blood group antigens on the surface of cancer cells may also alter cell motility leading to malignancy (Le Pendu *et al.,* 2001). However, the issue of influenced systemic inflammatory response have been reported in blood type A, as there is an association between the blood group A antigen and circulating levels of soluble intercellular adhesion molecule 1, E-selection and P Selection (Barbalic *et al.,* 2001; Paterson *et al.,* 2009).

Conclusion

ABO blood group antigens are present in the blood and other body fluid and the laboratory procedure for its typing is not difficult yet some scholars in the clinical and biomedical sciences have undermined this huge advantage that would have saved life and man hour. The blood group system have as well been helpful in knowing the risk involved in the development of one disease or the other, and if many were aware of this, maybe it would have been more utilized in serving as an indicative biomarker especially in preventive medicine and better management of patients if disease finally ensue. The study reviewed high prevalence of blood group O in the population followed by group A, B and AB accordingly. However, no correlation exists between ABO blood groups and breast cancer as recorded by some studies; this could be due to the fact that blood group A were less represented in this study as the risk of breast cancer was associated with group A whereas, the highly prevalent of

blood group O having an inherited protective factor against breast cancer. Further studies should be done with a larger population of breast cancer patient especially group A population; that is to say that racial and ethnic distribution should be put into consideration as well as other environmental factor especially in Niger Delta with the long history of environmental challenging episode with little or no remediation approach or strategy by the parties concerned to reduce the problem of health issues inherent from such activities.

Public Health Implications of Breast Cancer in association with ABO Blood group in rural community setup. The public health implication of breast cancer and its association to ABO blood group system remain very huge source of concern across the globe to researchers and professionals in public health intervention sector. However, the public health challenges of the above subject matter remains very massive and clearly visible in the developing communities where access to functional health care facility for prompt diagnosis and treatment remains a threat to both community and public health protection and advancement. Most times, it is believed that lack of well-trained man power, death of infrastructure and poor pattern of staff motivation could probably account for poor health care service delivery in some developing communities. Nonetheless, lack of health education in this direction to enlighten the general public especially the women folks on the risk factors that could promote the incidence of breast cancer is obviously lacking in our remote communities and the important of health education as strong element of public health promotion strategy cannot be over emphasized as the gains accruable from it would be helpful towards behavioural and attitudinal changes Also, poverty and unemployment is another limiting factor among subjects from the developing communities towards accessing good and quality health care, however, due to lack of fund and means of earning money the subjects resort to the use of herbal drug mixture that probably lack accurate measurement criteria in term of the content of the active ingredient in the right proportion.

Furthermore, it is the personal intuition of the researchers of this article based on the cofounding evidence based scenario in our local communities that lack of proper oil and gas waste disposal system in the Niger Delta communities may probably increase the incidence of cancer cases in our communities as some of these compounds contains heavy metals and other risk factor elements that could promote the trend but unknown to the local inhabitants. It is very important to state very clearly that solving the public health issues that are associated with the health issues of breast cancer and ABO grouping, therefore requires adequate political and scientific strong will, driven by robust evidence based studies especially in an environmentally challenging communities like our in Niger Delta where majority of the subjects may probably be vulnerable and susceptible to environmental risk factors that has remains unabated by the multinational in oil and gas and other allied companies, even as gas flaring activities is still going on in our communities without any hope or plan on ground of ending it in the near future.

Nevertheless, other confounding factors include the huge gap in health determinant indicators of the subjects that are living in the rural communities. Poor housing, lack of regular exercise, poor feeding habit, lack of education, lack of potable water and high risk life style remains a huge health challenge to grasp with among subjects from developing communities. It will be of interest to state that, drinking of water

that is contaminated with arsenic element is likely to come down with lung, skin and bladder cancer. It has remained an undisputable fact that majority of the rural communities in the Niger Delta lack access to safe and potable drinking water to sustain life, thus the only available sources of drinking water include the Rivers, Streams, wall and even rain water, hence the present of carcinogenic materials in water remains a public/community health issues that requires urgent attention by the relevant authorities. It is strongly believed that continuous health promotion intervention strategy especially in our communities would be a strong tool towards highlighting the risk factors and subsequently reducing the trend.

Conclusively, breast cancer is one of the most widespread cancers among women worldwide initially with high morbidity and mortality rates though there is a decline for some population across the globe. Prevention and management of breast cancer disease follow the pattern of early detection by breast examination and treatment options ranges from lumpectomy, mastectomy, chemotherapy, radiotherapy and hormonal therapy. This is challenging to the general population particularly to the women health, which is an aspect of concern in public health, as this group of individuals happen to be the most vulnerable group with this huge burden of disease. The mandate of World Health Organization is health for all, reducing the disease burden to the bearest minimum and the public health echo "prevention is better than cure" have kept some researchers in search of the best possible ways thus, the quest for solution promoted the introduction of antigenic markers in the blood as a diagnostic and predictive tool for breast cancer disease in women. Antigenic blood based phenotypes (blood group) been simple, rapid, easy test, accessible by majority, cheap with no variation have been adopted by some research driven communities as a prognosis for breast cancer disease risk. Measures should be put in place, policy should be made and implemented towards the utilization of this test (blood group) and it should be affordable, accessible and available in the three tiers of the health care sector including the primary health care facilities in our rural communities.

Molecular and genomic studies should be done especially among the black population because race and geographic location are strong factors. Breast cancer disease is multi-factorial with many confounders like family history, environmental factors cum exposure, genetic factors, life style. Also, recent technological approaches should be used like sequencing, proper health record and tracking system, development of comprehensive molecular and epidemiological data base system to provide individual gene pool specific studies that will put these multiple factors into consideration for clinical but mostly public health use.

Conflict of interest

No report of conflict of interest among authors, hence Participation, co-operation and engagement among authors were great and equitable in achieving all the milestones needed to complete this study.

Acknowledgement

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