Original Article

Socio-demographic and Haematological Determinants of Breast Cancer in a Tertiary Health Care and Teaching Hospital in Addis Ababa, Ethiopia

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Abstract

Background: Breast cancer is the major cause of cancer deaths among women globally. Socio-demographic and haematological characteristics are among the determinants of breast cancer, and these characteristics are supposed to be monitored during early diagnosis and treatment of cases.

Objective: The objective of this study was to assess socio-demographic and haematological profile of patients with breast cancer at Tikur Anbessa Specialized Hospital.

Methods: Case controlled study was conducted among 230 cases and 230 controls from May 2018 to June 2019. Descriptive analysis was made to assess socio-demographic characteristics and independent sample t- test was performed to compare the mean haematological parameters.

Results: The mean age was 42.8 $\pm$ 12.1 years and 39.3 $\pm$ 11.1 years for cases and controls, respectively. About 43.5% of the cases and 14.8% of the controls were not able to read and write. About 76.1% of the cases and 67.4% of the controls were married. The mean values of Haemoglobin, Red Blood cell, Packed Cell Volume for the cases were 13.1 $\pm$ 1.6g/dl; 4.6 $\pm$ 0.54x10^{12}/L; and 38.7 $\pm$ 4.5 %, respectively. These were significantly lower than those of the controls (14.0 $\pm$ 1.3g/dl, 4.8 $\pm$ 0.47 x 10^{12}/L, 40.5 $\pm$ 3.5%, respectively). Mean platelet count was higher among the cases, whereas total White Blood cell count was almost similar.

Conclusion and recommendations: Majority of the cases were less than 40 years of age and were not able to read and write. Most of the RBC parameters of cases were significantly lower than the controls. Therefore, attention should be given for exposed groups and those with the designated haematological abnormalities. [*Ethiop. J. Health Dev.* 2021; 35(2):125-132]

Keywords: Breast cancer, Haematological parameters, Socio-demographic factors, Ethiopia

Background

Breast cancer is the major cause of cancer deaths in women [1]. Though significant progress has been made in breast cancer prognosis and survival, the disease is still the main cause of death among women in low- and middle-income countries [1-3]. There is increase in magnitude of cancer in many African countries, but cancer controlling programs are still extremely low [4].

Socio-demographic factors are linked with breast cancer. According to findings from European countries including Sweden and Norway, higher socioeconomic status of women was significantly associated with breast cancer incidence [5]. Age, marital status, employment status, as well as educational status were determinants of breast cancer incidence as demonstrated by other studies from Iraq [6,7].

Age, marital status, employment status, as well as low educational status were determinants of breast cancer incidence as demonstrated by other studies from Iraq [6-7]. A WHO survey conducted in low-income countries found that country health spending, health care access, rural residence and socioeconomic status were significant factors for cancer screening [8]. In Nigeria, socio-demographic factors increased the risk of late presentation [9].

Breast cancer is the leading cause of morbidity and mortality in Ethiopia, too, gaining conducive opportunities due to long patient delay and advanced stage at diagnosis [10] Trend of breast cancer is increasing, and it is the most predominant type of cancer in Ethiopia [11, 12]. In general, cancer contributes for 5.8% of the total national mortality [13]. It is also found that breast cancer is highly posing a significant public health problem in Ethiopia [14]. On the other hand, most cancer patients have poor awareness. As a result, majority of patients seek treatment at advanced and incurable stage of the disease [15].

Haematological abnormalities are common features to be considered in breast cancer patients. Those parameters could be used as one of the important biochemical tools in the diagnosis of other co-morbidities and treatment monitoring in breast cancer patients [16]. Studies indicate haematological parameters as important investigations that are useful prognostic factors for evaluating the accuracy of risk stratification in breast cancer patients [17, 18]. Studies done in Nigeria showed that most of the haematological parameters were significantly lower among breast cancer patients than among controls [18, 19]. Hematologic parameters were also significantly lower in patients in Iraq [20]. A study in Malaysia revealed that 22% of breast cancer patients had significantly decreased haemoglobin value [21].

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Studies in Ethiopia indicated that, at the time of diagnosis, 80–90% of patients suffer from advanced and incurable cancers [15, 22-24]. Socio-demographic factors may have influence on late presentation and contribute to neglecting sign and symptoms, illnesses, as well as late notifications and treatment delay [9]. Since breast cancer is associated with lifestyle, it is important to investigate and recognise various socio-demographic elements of patients with the disease. Even though breast cancer incidence has increased rapidly in Ethiopia [13], there is still lack of studies that investigated socio-demographic and haematological profile of breast cancer patients. It is important to assess haematological status of breast cancer patients at regular intervals during different stages of treatment to determine their diagnostic and prognostic values, which can help for improved management. Therefore, this study was aimed to assess socio-demographic and hematologic profiles of patients with breast cancer at Tikur Anbessa Specialised Hospital.

Materials and Methods

Study design and period: Hospital-based case control study was done at Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia. The study was conducted from May 2018 to June 2019. Cases and controls were matched based on residence within and outside Addis Ababa.

Eligibility criteria

Since breast cancer mainly affects women, only women patients and controls aged 18 years and older were included in the study. Cases were all newly diagnosed breast cancer patients with confirmed histology result, no recognizable mental illnesses, and no history of chronic illness. On the other hand, controls were women accompanying breast cancer patients who had no biological relationship with selected cases, no history of chronic illness, and who were free from breast mass.

Sampling and sample Size determination

Tikur Anbessa Specialized Hospital was selected for the study since it was the only referral centre for cancer treatment during the study period. All eligible and voluntary breast cancer patients that came to TASH during the study period were included as cases and controls based on convenient sampling technique.

The sample population of the cases was female breast cancer patients referred to TASH Oncology department, who fulfilled inclusion criteria and who gave informed consent. For the controls, the sample population was women caregivers accompanying breast cancer patients.

Sample size was calculated using Open Epi by assuming old age (>50 years) as a risk factor for breast cancer, 80% power, 0.05 significance level at 95% CI, and 1:1 ratio of case to control. Percentage of exposed among control group was 11.9%, percentage of exposed among cases 21.6%, (Ibrahim, 2010), and odds ratio of 2.05. Finally, the total sample size was 460 (230 cases and 230 controls).

Data collection, management, and analysis

Prior to data collection, written informed consent was obtained from each study participant. Haematological parameters of breast cancer patients were recorded from their laboratory reports. Eligible controls were selected by breast physical examination. Then, interview was conducted by experienced nurses. Blood sample was collected at the end of each interview and the sample was analysed at TASH Laboratory using Sysmex KX –21N Haematology analyser. Data was analysed by using Statistical Package for Social Science (SPSS) version 20 Software. Then, descriptive analysis was made to assess socio-demographic characteristics of the study participants. Independent sample t-test was used to compare mean $\pm$ standard deviation of different haematological parameters. In addition, Chi square test was conducted to see significant difference of haematological parameters between cases and controls. P- values less than 0.05 were considered statistically significant.

To assess presence of selected haematologic abnormalities, the reference range was taken from WHO and from the output of CBC SYSMEX KX –21N haematology analyser. Regarding anaemia, WHO 2011 haemoglobin (HB) concentration cut-offs for the diagnosis of anaemia and assessment of severity was used. As per this assessment, if HB concentration is $\geq$12gm/dl, there is no anaemia, HB level 10.9 - 11.0gm/dl is associated with mild anaemia, HB 8.0-10.9 gm/dl suggestive of moderate anaemia and severe anaemia is indicated by HB less than 8gm/dl. In addition, anaemia was further characterised as microcytic and macrocytic based on MCV values; and as hypochromic and normochromic anaemia based on MCHC values. Leucocyte and platelet values were also characterised based on the reference range of haematology analyser. When WBC count was less than 3.7 x 10^9/L, it was characterised as leucopoenia, whereas when the value was greater than 10.4 x10^9/L, it was characterised as leucocytosis. Regarding the platelet count, if the platelet count was less than 140 x 10^9/L, it was characterised as thrombocytopenia; whereas, when the value was greater than 385 x 10^9/L, it was characterised as thrombocytosis.

Data quality control and assurance

To minimise errors when using hospital controls, healthy controls were selected after breast physical examination was made. And to facilitate their understanding of the issues, questionnaire was prepared in English and translated to Amharic. For those who did not speak Amharic language, we used care givers and nurses as translators. Data collection tools were pretested, and training was given for data collectors. Daily supervision was made on all questioners collected on each day. All collected blood specimens were analysed on the same day of sample collection. Control samples were analysed before testing actual patient samples.

Ethical considerations

Ethical approval was obtained from Addis Ababa University, College of Health Sciences Institutional Review Board. Written informed consent was obtained

from each respondent. Confidentiality and privacy were maintained throughout the study. During selection of controls, women who had breast mass were consulted by physician and their results were given for free to get early diagnosis and treatment.

Results

Socio-demographic characteristics of the study participants: In this study, 230 cases and 230 controls were included. Majority (i.e., 70.9%) of the cases and 75.7% of the controls were urban dwellers. Mean ages of the study participants were 42.83 ± 12.06 and 39.33 ± 11.14 years ($P < 0.05$) for cases and controls, respectively. More than half (54.3%) of cases and 62.2% of the controls were less than 40 years old (Table 1). Regarding marital status, 76.1% of the cases and 67.4% of the controls were married. However, nearly half (43.5%) of the cases were not able to read and write, while 30% of the controls had attained secondary education. More than two-third (69.6%) of the cases and 43.1% of the controls were housewives. Even though limited number of study participants replied to the question about their income, 34.3% of the cases and 12.6% of the controls had less than 1000 Ethiopian Birr per month (Table 1).

Table1. **Socio demographic characteristics of study participants at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, 2019**

Variables	**Cases**		**Controls**	
Residence	**Frequency**	**Per cent**	**Frequency**	**Per cent**
Urban	163	70.9	174	75.7
Rural	67	29.1	56	24.3
Age group (years)				
<40	125	54.3	143	62.2
40 and above	105	45.7	87	37.8
Mean age (Mean ±SD)	42.83 ± 12.06		39.33 ± 11.14	
Marital status				
Single	23	10.0	29	12.6
Married	175	76.1	155	67.4
Divorced/widowed	32	13.9	46	20.0
Education level				
Not able to read and write	100	43.5	34	14.8
Able to read and write	26	11.3	9	3.9
Primary education	33	14.3	56	24.3
Secondary education	45	19.6	69	30.0
College and University	26	11.3	62	27.0
Occupation				
Housewife	160	69.6	99	43.1
Government employee	34	14.8	70	30.4
Private	16	7.0	42	18.2
Other	20	8.6	19	8.3
Income (ETB)	**(N=108)**		**(N=127)**	
< 1000	37	34.3	16	12.6
1000 -2000	32	29.6	37	29.1
2001-3000	10	9.3	27	21.3
Greater than 3000	29	26.9	47	37.0

Haematologic profile of breast cancer cases and controls

Haemoglobin, red blood cells, platelet count and packed cell volume: The overall mean values with standard deviation of HB, RBC, PCV, of cases were (13.1 ± 1.6g/dl, 4.6 ± 0.54 x 10^{12}/L and 38.7 ± 4.5 %, respectively and those values for controls were 14.0 ± 1.3g/dl, 4.8 ± 0.47 x 10^{12}/L, 40.5 ± 3.5%, respectively (Table 2). On the other hand, mean platelet count for the cases and controls were 323.4 ± 108.1x10^{9}/L and 282.0 ± 70.0 x 10^{9}/L, respectively.

Table 2. **HB, RBC, platelet count and PCV parameters of cases and controls at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, 2019**

Parameter	Cases	Controls	P – value
HB (Mean±SD) g/dl	**13.1±1.6**	**14.0± 1.3**	**0.0001**
Minimum HB	8.7	7.3	
Maximum HB	16.4	20.1	
RBC (Mean±SD) x 10^{12}/L	**4.6±0.54**	**4.8±0.47**	**0.020**
Minimum RBC	2.84	3.39	
Maximum RBC	6.18	7.12	
Platelet (Mean±SD) x 10^9L	**323. 4±108.1**	**282.0±70.0**	**0.0001**
Minimum Platelet	110.0	119.0	
Maximum Platelet	827.0	469.0	
PCV (Mean±SD) %	**38.7±4.5**	**40.5±3.5**	**0.0001**
Minimum PCV	26.20	24.80	
Maximum PCV	49.20	58.40	

Red cell induces.

The overall MCV, MCH and MCHC values were 84.3 ± 8.1fl, 29.0±4.2pg, and 33.7 ± 1.7% for the cases and 85.7 ± 6.0 fl, 29.5 ± 2.4pg, 34.2 ± 2.5% for the controls (Table 3). MCV and MCHC values were significantly lower among breast cancer patients (P <0.05) (Table 3).

Table 3. **Red cell indices values of study participants at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, 2019**

Red cell indices parameters	Cases	Controls	P- value
MCV, fl (Mean±SD)	**84.3±8.1**	**85.7±6.0**	**0.042**
Minimum MCV	65.6	62.4	
Maximum MCV	105.9	111.5	
MCH, pg (Mean±SD)	**29.0±4.2**	**29.5±2.4**	**0.153**
Minimum MCH	21.2	19.3	
Maximum MCH	37.5	39.2	
MCHC, gm/dl (Mean±SD)	**33.7±1.7**	**34.2±2.5**	**0.005**
Minimum MCHC	22.4	29.4	
Maximum MCHC	38.5	36.6	

Key= *MCV* = Mean Cell Volume; *MCH*= Mean Cell Haemoglobin, *MCHC*= Mean Cell Haemoglobin Concentration, SD= *Standard deviation, fl = femtoliter, pg = pico gram*

Total WBC and WBC differential parameters: In this study, the mean value of total WBC was 7.1 ± 2.8 and 7.1 ± 2.4 x 10^9/L for cases and controls, respectively. The mean neutrophil, lymphocyte, monocyte and eosinophil counts (55.19 ± 13.96%, 29.67 ± 11.21%, 10.14 ± 5.54%, and 4.05 ± 4.65%, respectively) of the cases were, significantly higher than the mean counts for the controls, which were 36.39 ± 19.27%, 24.58 ± 8.40%, 5.51 ± 2.08%, and 2.80 ± 3.88%, respectively.

Characterization of some selected hematologic parameters: In this study, 20.4% of the cases and 5.6% of the controls were anaemic based on their haemoglobin value. Based on severity of anaemia, 11.7% of the cases and 1.7% of the controls were moderately anaemic. On the other hand, 8.7% of the cases and 3.5% of the controls were mildly anaemic (P=0.0001) (Table 4).

Table 4. **Distribution of abnormal haemoglobin, leucocyte and platelet values between breast cancer cases and controls at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, 2019**

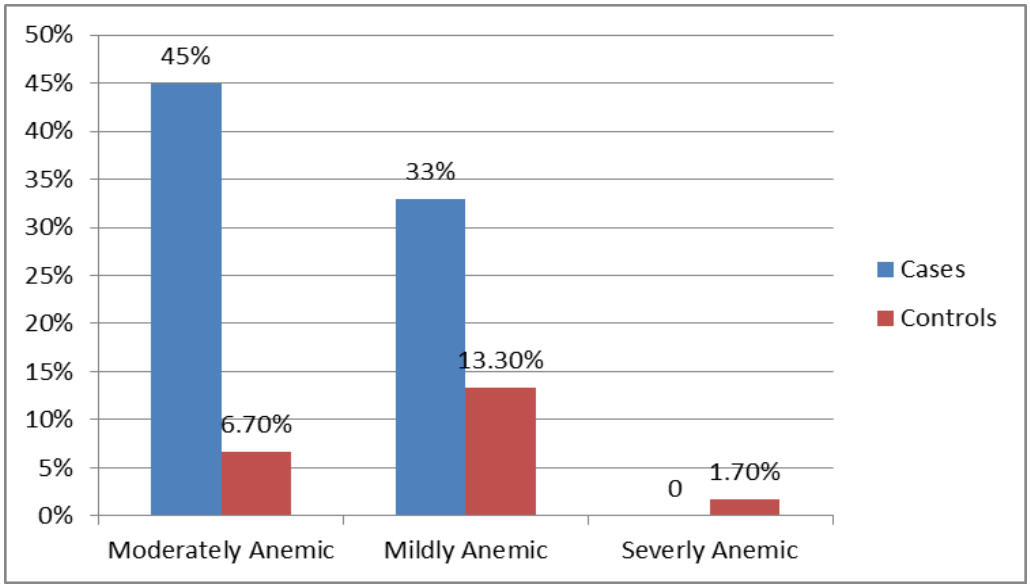
Parameters	**Cases**		**Controls**		**P - value**
Haemoglobin (gm/dl)	***N***	***%***	***N***	***%***	
12 and above (No anaemia)	183	79.6	217	94.3	
Mild anaemia	20	8.7	8	3.5	0.0001
Moderate anaemia	27	11.7	4	1.7	
Severe anaemia	0	0	1	0.4	
Microcytic anaemia	64	28.2	42	18.4	
Macrocytic anaemia	2	0.9	3	1.3	0.046
Hypochromic anaemia	15	6.6	8	3.5	0.134
Normocytic anaemia	23	10.0	7	3.0	0.003
Normochromic anaemia	27	11.7	9	3.9	0.002
Microcytic Hypochromic	9	3.9	4	1.7	0.159
Leucopoenia	13	5.7	9	3.9	0.681
Normal	198	86.1	202	87.8	
Leucocytosis	19	8.3	19	8.3	
Thrombocytopenia	4	1.7	5	2.2	
Normal	172	74.8	207	90	0.0001
Thrombocytosis	54	23.5	18	7.8	
Both anaemic and thrombocytosis	16	7.0	1	0.4	0.0001
Both anaemic, thrombocytosis and leucocytosis	5	2.2	0	0.0	0.025

**The reference range is based on the WHO classification of anaemia. Regarding leucocyte and platelet, the reference range is based on the established range of the CBC Sysmex* KX – 21N *haematology analyser.*

**Anaemia, When HB<12gm/dl, (Mild anaemia when HB is 10.9-11.0 gm/dl, Moderate anaemia when HB is 8.0-10.9 gm/dl, and Severe anaemia when HB is <8 gm/dl)*

** Leucocytosis: when total WBC count is >10.4 x 10^9/L, Leucopoenia: when total WBC count is < 3.7 x 10^9/L.*

Out of the total anaemic study participants, 33.3% of the cases and 13.3% of the controls were mildly anaemic. Moderately anaemic participants accounted for 45% of the cases and 6.7% of the controls. Only 1.7% of the control group were severely anaemic (Figure 1).



***Classification of Anaemia:** *When HB<12gm/dl, (Mild anaemia when HB is 10.9-11.0 gm/dl, Moderate anaemia, when HB is 8.0-10.9 gm/dl, and Severe anaemia when HB is <8 gm/dl)*

Figure 1. **Severity of anaemia among breast cancer cases and controls at Tikur Anbessa Specialized Hospital, Addis Ababa, 2019**

Regarding characterisation of anaemia, microcytic anaemia was found among 28.2% of the cases and 18.4% of the controls. However, microcytic anaemia was found among 0.9% of the cases and 1.3% of the controls. Similarly, 6.6% of the cases and 3.5% of the controls had hypochromic anaemia. It was also found that 10.5% of the cases and 3% of the controls were with normocytic anaemia; 11.7% of the cases and 3.9% of the controls were with normochromic anaemia and 3.9% of the cases and 1.7% of the controls were with microcytic hypochromic anaemia (Table 4). Thrombocytosis was found among 23.5% of the cases and 7.8% of the controls (P=0.0001) (Table 4). The finding also indicated that 7.0% of the cases and 0.4% of the controls were both anaemic and with thrombocytosis (P=0.0001). Similarly, 2.2% of the cases and none of the controls had the triple burden of anaemia, leucocytosis, and thrombocytosis (Table 4).

Discussion

Breast cancer is a major public health problem among women both in developed and developing countries. Its incidence is rapidly increasing [1-3]. In general, different socio demographic and hematologic characterisations are important and should be considered to maximise treatment success and patient survival. In this study, 54.3% of the study participants were less than 40 years of age. This finding is comparable with different studies conducted in Ethiopia [11,12, 25] but not with a study conducted in Iraq [20]. This difference could be due to lifestyle, diet, genetic characteristics, population characteristics and related factors. Even though breast cancer incidence is supposed to be higher in above 50 years of age, in this study, 15.2% of cases were found to be less than 30 years old, which is comparable with another study done in Ethiopia [25]. However, this study is incomparable with a study done in India, which indicated that there is no breast cancer case among those that were under 30 years of age; this difference, could be due to lifestyle, genetic factors, and the population distribution of the country [21]. In general, this study revealed that the majority (that is 76.5%) of breast cancer patients were less than 50 years old. This finding is somehow comparable with a study done in Pakistan [26].

Regarding educational status, 43.5% of the cases and 14.8% of the controls were not able to read and write. This result is not comparable with findings reported in Sindh. The difference could be due to smaller sample size and study setting (26). In general, large proportion (34.3%) of cases as opposed to 12.6% of the controls had a monthly income of less than 2000 Ethiopian Birr. However, another study indicated that the prevalence of breast cancer was higher among socioeconomically better off individuals, presumably due to lifestyle risks they are exposed to [27]**.** The majority (i.e., 76.1%) of the cases were married. That seems to be consistent with results of studies done in Bagdad and Pakistan [6, 26].

Haematological parameters are examinations which are usually accessible with minimum costs. These parameters provide helpful evidence regarding many types of illnesses, including cancer [20]. This study found that the mean HB, PCV, and RBC counts were significantly lower in patients than in controls. This finding is consistent with studies done in Iraq [20], Nigeria [18], and Sindah [26].

Since HB and PCV are used as guides to diagnose anaemia, which is one of the major problems among most of the cancer patients, those parameters were usually lower for the cases than for the healthy controls [18, 26]. This low level of haematological parameters may be associated with bone marrow or immune suppression, because of the cancer itself [18]. The other possible reason could be if the patients were on pre- or post-surgery conditions, these parameters can be significantly reduced. In addition, nutritional status and clinical conditions of patients could also play important role in the reduction of such values [28, 29]. The mean MCV and MCHC were significantly lower among cases than among controls. This finding is in conformity with results of a study done in Nigeria [19]. Except for MCH, it is also supported by a study done in India [30].

The mean platelet count was significantly higher among patients than controls. This finding is comparable with similar studies done in India and Nigeria [16, 19]. This increment could be explained by the reactive thrombocytosis among most breast cancer patients because of cancer-induced anaemia. However, this finding is divergent from results of similar study conducted in Iraq [20]. This difference could be due to small sample size, clinical characteristics, and demographic differences of the study participants. In this study, the mean neutrophil and lymphocyte counts were higher among the cases than with the controls, and the higher counts could be explained by neoplasm of cancer cells. This finding is consistent with a study conducted in Nigeria [19]. In this study, anaemia was found in 20.4% of the cases and 5.6% of the controls, a result which conforms with similar studies conducted in Ethiopia and China [31, 32].

In contrast to the current study, researchers from India reported that 60% of pre-chemotherapy breast cancer patients were anaemic [28]. This inconsistency in the findings could be due to smaller sample size of the Indian study, due to difference in study set up and background of the study participants. This study also indicated that leukopenia was found in 5.7% of the cases and 3.9% of controls. The finding is nearly comparable with a study done in India [33]. Thrombocytosis was observed among 23.5% of the cases and 7.8% of the controls. This study was also nearly comparable with a study done in Switzerland [34].

Limitations

This study is a hospital-based investigation; its results may not hold for the general population. In addition, even though breast physical examination was made by experienced physician, physical examination may not be sufficient to detect potential breast mass.

Conclusion and Recommendations

This study observed that most of the breast cancer patients were young and there were significant numbers of breast cancer cases even under the age of 30 years. More than two-fifths (43%) of breast cancer cases were not able to read and write, with low monthly income. Regarding haematological parameters, the mean haemoglobin, red blood cell count, packed cell volume, mean corpuscular volume; and mean corpuscular haemoglobin concentration values were significantly lower among cases compared to controls. On the other hand, some haematological parameters like platelet count, neutrophil count, are significantly higher among controls. Anaemia and thrombocytosis were also observed as major hematologic abnormalities among breast cancer patients.

Since younger women were highly affected by breast cancer, attention should be given by concerned bodies for the young population in every aspect of prevention and control activities of breast cancer. Since this study may not provide representative evidence, it is important to conduct further studies with large sample size to confirm the findings of this study and design appropriate interventions.

Conflict of Interests

- All authors declare that there is no conflict of interest regarding the publication of this paper.

Authors' Contribution:

- I state that this research was done by all authors indicated in this article. All of the authors participated starting from conception and design the study through the preparation of this manuscript. Finally, all authors critically reviewed and approved the manuscript.
- This study may help to identify the target group for counselling and awareness creation, depending on their needs in the general population.

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