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EPIDEMIOLOGY INCIDENCE AND MORTALITY OF BREAST CANCER AND ITS ASSOCIATION WITH THE BODY MASS INDEX AND HUMAN DEVELOPMENT INDEX IN THE ASIAN POPULATION

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Abstract – *Objective:* *The factors affecting the incidence of breast cancer are highly variable. The high prevalence of overweight and obesity, inappropriate lifestyle and socio-economic status are associated with breast cancer. Therefore, this study investigates morbidity, mortality, and association of breast cancer with Body Mass Index (BMI) and Human Development Index (HDI) in the Asian countries.*

Materials and Methods: *The study is based on the data acquired from the World Cancer Bank and World Bank (including HDI and its components). In this population-based study, we estimated the Population Attribution Frequency (PAF) by using the BMI in adult communities. The prevalence, mortality rates and distribution maps for breast cancer were extracted for different countries. Correlation and regression tests were used to analyze the data and examine the relationship between the prevalence and mortality with HDI. The statistical analysis of data was performed by Stata-14 and the significance level was considered as 0.05.*

Results: *The results showed that there is a positive and significant correlation between the incidence of breast cancer associated with the BMI and HDI ($R=0.371$, $p<0.05$). On the other hand, our findings showed that the higher the developmental index, the greater the percentage of breast cancer prevention associated with BMI. Moreover, there is a positive and significant correlation between the prevention and HDI ($p=0.522$, $p<0.05$).*

Conclusions: *Obesity increases the likelihood of fatal cancer types and their recurrence, including BC. The risk of breast cancer in developed and developing countries, including the Asian countries, is increasing. Therefore, the modification of breast cancer risk factors needs to be emphasized to prevent it.*

KEYWORDS: *Epidemiology, Incidence, Mortality, Breast cancer, BMI, HDI, Asia.*

INTRODUCTION

Cancer and obesity are two main concerns in today's societies since both are increasing[1-3]. Breast cancer is the most common and deadly malignancy and the second leading cause of death after lung cancer among women[4-6]. It accounts for 23% of all cancers in women[7,8]. Breast cancer involves 1 woman per 8 women[9], and the likelihood of having it throughout the lifetime is 12.5%[10]. The statistics indicate that every three minutes one woman is diagnosed with breast cancer, and every 12 minutes a woman dies because of it[11]. In the United States in 2013, among women, 232340 new cases of invasive breast cancers were identified, and nearly 39620 deaths associated with this cancer occurred [12].

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Various factors such as age, sex, race, religion, previous benign condition in breast, previous history of cancer, factors related to pregnancy and hormones, familial history of breast and ovarian cancers, ionizing radiation, and environmental factors are involved in the pathogenesis and progression of breast cancer[13-16]. The incidence of breast cancer after the age of 35 is higher in women, and is almost constant after the age of 80[17]. Another important risk factor is obesity that greatly increases the risk of breast cancer[18]. According to studies, there is a strong relationship between the risk of breast cancer and BMI. In some studies, 30% of breast cancer patients were obese[19]. The risk of breast cancer in postmenopausal women was higher 1.5 times. It is two times more in obese women than lean women[20]. The risk of malignant cancers and breast cancer in women with a BMI greater than 30, in comparison with women with a BMI equal to 20-24.9%, is reported to be 22% higher[21]. One of the possible causes of an increased risk of breast cancer associated with overweight and obesity can be high levels of estrogen, because fat tissues are the largest source of estrogen in women[22]. An increase in body fat also causes macrophage penetration into the tissue that reacts with adipocytes and releases inflammatory cytokines. High production of inflammatory adipocytokines has been confirmed in obese and type II diabetic patients[23]. In fact, one of the mechanisms of obesity in the incidence of breast cancer is adipocytokines and their function[24,25]. According to studies, several risk factors for breast cancer have been mentioned, among which the most important are obesity, improving socio-economic status, lifestyle, increasing life expectancy and the Human Development Index (HDI)[26]. Overweight and obesity are increasing rapidly in developing countries and industrialized countries[27,28] and are among the few changeable risk factors for breast cancer[29,30]. Thus, in this work we aimed at evaluating morbidity, mortality and the association of breast cancer with BMI and HDI in the Asian countries.

MATERIALS AND METHODS

Availability of data on the incidence and mortality rate

The evaluation and measurement method of the incidence of mortality rate is unique to each country. The research quality is based on the population and the quality of the data available in each country. Several ways are used in each community to achieve this goal. As these methods are complex and various, it is relatively impossible to determine the quality values of the mortality rate. However, there is an alphanumeric rating system that describes the incidence of mortality rate and their related information at the national level.

Incidence rate

In each country, the incidence of breast cancer is evaluated based on age and sex using the following categories:

1. Approximate amounts or ratios by 2012 (38 countries).
2. The most recent rates were used for the 2012 population (20 countries).
3. Estimates of country mortality rates by modeling and using death rates obtained from data of the National Cancer Archives (13 countries).
4. Estimates of mortality rates by modeling and using mortality rates obtained from data of the National Cancer Archives among countries with shared borders (9 European countries).
5. Estimates of the national mortality rates based on the modeling survival rate (32 countries).
6. Estimates of the country mortality rates based on the average local rate (16 countries).
7. A cancer archive, which is covering a part of the country, has been considered as the representative of the entire country profile (11 countries).
8. Age and sex-related rates for all cancers are categorized based on the available data on the relative number of cancers (based on age and sex) (12 countries).
9. Neighboring countries rate or archives in one region (33 countries).

Mortality rate

Based on the exact amount and accuracy of data related to mortality rates in the country, the following 6 methods are used in the order of priority as follows:

1. Approximate rates by 2012 (69 countries).
2. The most recent rate apply for the population of 2012 (26 countries).
3. Estimates of mortality rates based on the average local rate (one country).
4. Estimates of the national incidence by modeling and using country-specific rates (2 countries).
5. Estimates of the rate of occurrence of the country using the modeling rates (83 countries).
6. Rates of neighboring countries or archives in one region (33 countries)[14].

BMI

The researchers used the average BMI and standard deviation of age and sex for adults over 20 years old in each country during 1982-2002. Age groups ranged from 20-34, 35-44, 45-54, 55-64, 65-74, and 75 years or higher.

Relative Risk Estimates (RR)

Only cancer cases have been reported that the World Cancer Research Foundation (WCRF) has provided them with adequate evidence of BMI, including ad-

enocarcinoma (cancers with malignant tumors) and cancers of the esophagus, rectum, colon, kidney, pancreas, bladder, breast cancer after menopause and uterus and ovary cancers. The relative gender risk in different regions is derived from the analysis of standard tests published by the WCRF and its Continuous Update Project (CUP).

Population attributable fraction (PAF)

PAF is calculated using the proposed methods based on the following formula:

$$PAF = \frac{\int RR(x)P(x)dx - \int RR(x)P^{*}(x)dx}{\int RR(x)P(x)dx}$$

Where P (x) is the BMI population distribution, P*(x) is the theoretical minimum distribution of BMI, and RR(x) is the relative risk of cancer associated with BMI to the value or amount of x.

The theoretical minimum distribution BMI is defined as an average of 22 Kg/m^2 and standard deviation of 1, where the burden of disease is at the lowest level of population assumed. The log-logit function is used to detect the RR shape among BMI units for BMIs less than 22Kg/m^2, no risk is assumed, and for BMI above 40 Kg/m^2 no increase in risk was assumed[31,32].

The incidence rate of cancer and the attributable burden of cancer

Due to the impact of time on gaining weight and developing cancer (for example 10 years), the cancer burden appears only in cancers due to weight gain in adults aged 20 or more years which lasted 10 years or more. Accordingly, the number of cancer cases based on age (over 30 years old), sex, and the country based on GLOBOCAN was calculated in 2012. Countries are classified into 12 geographic areas:

Semi-arid countries (East, Middle, South and West of Africa), the Middle East (West Asia), North Africa, Latin America (Central and South America), Caribbean, North America, East Asia (including China), Southeast Asia, South Central Asia (Central and Southern Asia including India), Northern Europe, Eastern Europe, Southern Europe, Western Europe and Oceania (including New Zealand and Australia).

HDI

HDI is a composite indicator of three dimensions: the degree or amount of studies, life expectancy and the ability to control the needed resources for a good life. All regions and groups that experience significant advances in all HDI components progress more rapidly than those with low or intermediate HDIs. According to this index, the world is not an equal place, because the value of national averages conceals a large part of the various experiences of human life. Many of the inequalities found in the northern and southern countries are observed. Inconsistencies in the income have increased in many countries[33,34].

Statistical analysis

In this study, the bivariate correlation method was used to assess the correlation between incidence rate and mortality rates of breast cancer and HDI. Linear regression models have been used to measure the effect of HDI on the incidence and mortality rate of breast cancer. The significance level is less than 0.05. Analyses were performed using the Stata-14 software.

RESULTS

Breast cancer is the second most common cancer in the world and, by far, the most frequent cancer among women with an estimated 1.67 million new cancer cases diagnosed in 2012 (25% of all cancers). It is the most common cancer in women both in more and less developed countries, with slightly more cases in less developed (883000 cases, 23%) than in more developed (794000, 27.9%) regions. Incidence rates vary nearly four-fold across the world regions. In the East Mediterranean, 992284 cases (33.9%), the African region 99670 cases (26.2%), the American region 408281 cases (28.6%), the Western Pacific region 329762 cases (17.3%), the South-East Asia region 239612 cases (26.4%), IRAC membership (24 countries) 934832 cases (27.9%), the United States 232714 cases (29.9%), European Union (EU-28) 361608 cases (13.7%), and in Iran 9795 cases (24.5%) of breast cancer were registered in 2012 (Table 1, Figure 1). Breast cancer ranks the fifth cause of death from cancer (522000 deaths, 14.7%). While it is the most frequent cause of cancer death in women in less developed regions (324000 deaths, 14.3%), it is now the second cause of cancer death in more developed regions (198000 deaths, 15.4%) after lung cancer. The range in mortality rates between the world regions is less than that for incidence because of the more favorable survival of breast cancer in (high-incidence) developed regions. In the East Mediterranean region 42228 cases (13.9%), the African region 49061 cases (19.6%), the American region 92058 cases (14.9%), the Western Pacific region 85837 cases (7.8%), the South-East Asia region 109631 cases (19.8%), IRAC membership (24 countries) 256832 cases (16.4%), the United States 43909 cases (15%), European Union (EU-28) 91585 cases (35.3%), and in Iran 3304 cases (14.2%) of death related to breast cancer were registered in 2012 (Table 1, Fig. 1).

TABLE 1. Incidence and mortality of breast cancer in the world in 2012.

Regions	Incidence			Mortality		
	No.	%	ASIR	No.	%	ASMR
World	1671149	25.1	43.1	521907	14.7	12.9
More developed regions	788200	27.9	73.4	197618	15.4	14.9
Less developed regions	882949	23	31.3	324289	14.3	11.5
WHO Africa region (AFRO)	99670	26.2	34.5	49061	19.6	17.2
WHO Americas region (PAHO)	408281	28.6	67.6	92058	14.9	14
WHO East Mediterranean region (EMRO)	99284	33.9	41.9	42228	13.9	18.6
WHO South-East Asia region (SEARO)	239612	26.4	27.8	109631	19.8	12.9
WHO Western Pacific region (WPRO)	329762	17.3	28.6	85837	7.8	7
IARC membership (24 countries)	934832	27.9	56.9	256832	16.4	14.3
United States of America	232714	29.9	92.9	43909	15	14.9
European Union (EU-28)	361608	13.7	80.3	91585	35.3	15.5

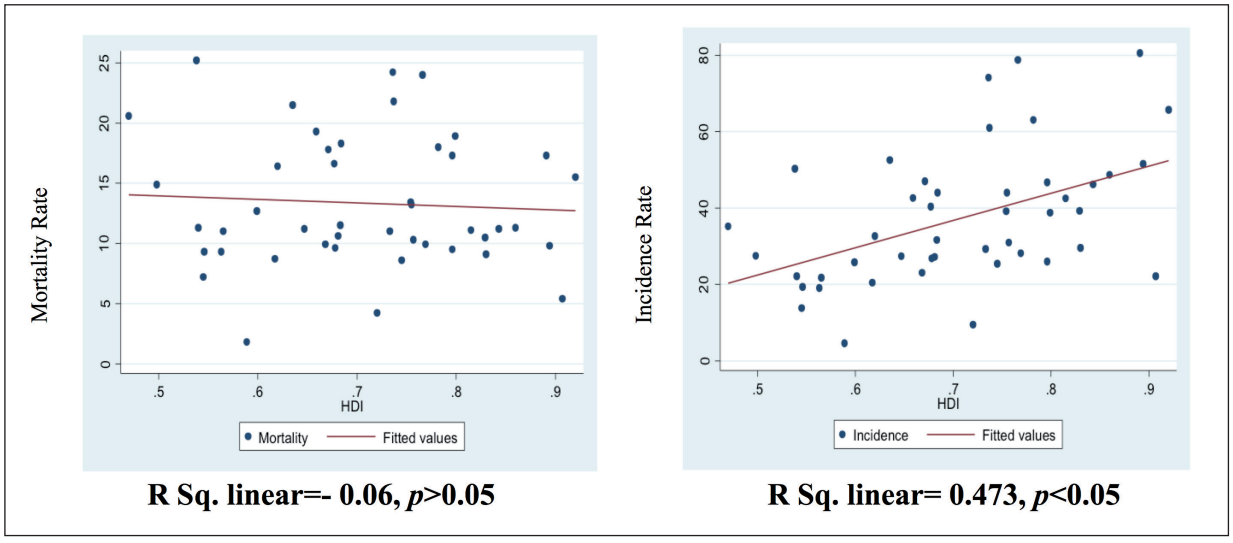
The results of the study showed that the highest incidence rate of breast cancer in the Asian continent was in the countries of Israel (80.5% per 100000), Lebanon (78.7% per 100000) and Armenia (74.1 per 100000), respectively, and the highest mortality rate was in the countries of Pakistan (25.2 per 100000), Armenia (24.2 per 100000), and Lebanon (24 per 100000) (Table 2).

The results of the study showed that there is a positive and significant correlation between the incidence of breast cancer and the HDI (R = 0.473, $p<0.05$), while there was a negative correlation between mortality rates with HDI, which was not statistically significant (R=-0.06, $p>0.05$) (Figure 1).

Regarding the status of BMI and the incidence of cancer in Asia, the results showed that about 108900 cases in both genders were attributed to BMI. In women, about 80,000 cases of cancer were attributed to BMI. The highest percentages of all cancers associated with BMI were reported from the Western Asia, covering Kuwait (10.6%), Jordan (9.9%), Israel (9.5%), and Armenia (9.5%). The lowest percentage of all cancers associated with BMI was reported from Bangladesh (0.35%), Nepal (0.61%) and Vietnam (0.65%).

The results of the study showed that the highest incidence of breast cancer related to BMI was in Kuwait (18.5%), Jordan (18.1%) and United Arab Emirates (17.3%).

The results showed that the highest percentage of breast cancer associated with BMI was in Maldives (7.7%), Iran (5.9%) and Lebanon (5.8%) (Table 3, Figure 2, Figure 3).



R Sq. linear=- 0.06, $p>0.05$ **R Sq. linear= 0.473, $p<0.05$**

Fig. 1. Correlation between incidence and mortality rates of cancer breast with HDI in Asia in 2012.

TABLE 2. Incidence and mortality rates for breast cancer in females in Asia in 2012.

Country	Incidence			Mortality			HDI
	No.	(%)	ASR (W)	No.	(%)	ASR (W)	
Eastern Asia							
China	187213	24.4	22.1	47984	7.3	5.4	0.907
Japan	55710	85.9	51.5	13801	21.3	9.8	0.894
Korea, Democratic Republic of	5707	37.4	36.8	2340	18.7	14.3	--
Korea, Republic of	17140	70.3	52.1	2274	9.3	6.1	--
Mongolia	125	11.0	9.4	50	3.5	4.2	0.720
South-Eastern Asia							
Brunei	83	40.6	48.6	18	8.8	11.3	0.860
Cambodia	1255	14.4	19.3	585	7.9	9.3	0.546
Indonesia	48998	34.7	40.3	19750	16.1	16.6	0.677
Lao PDR	472	17.0	19.0	222	7.0	9.3	0.563
Malaysia	5410	40.8	38.7	2572	17.8	18.9	0.799
Myanmar	5648	28.6	22.1	2792	11.3	11.3	0.540
Philippines	18327	38.1	47.0	6621	13.8	17.8	0.671
Singapore	2524	96.8	65.7	628	24.1	15.5	0.920
Thailand	13653	21.7	29.3	5092	14.3	11.0	0.733
Timor-Leste	108	19.3	32.6	52	8.9	16.4	0.620
Viet Nam	11067	29.7	23.0	4671	10.3	9.9	0.668
South-Central Asia							
Afghanistan	3108	45.7	35.1	1695	10.5	20.6	0.470
Bangladesh	14836	22.9	21.7	7142	9.5	11.0	0.565
Bhutan	13	8.7	4.6	5	1.4	1.8	0.589
India	144937	16.4	25.8	70218	11.5	12.7	0.599
Iran, Islamic Republic of	9795	38.4	28.1	3304	8.9	9.9	0.769
Kazakhstan	6252	73.5	63.0	1865	21.9	18.0	0.782
Kyrgyzstan	662	15.5	27.3	265	9.6	11.2	0.647
Maldives	41	18.6	31.6	14	8.7	11.5	0.683
Nepal	1716	14.8	13.7	865	5.5	7.2	0.545
Pakistan	34038	38.4	50.3	16232	18.3	25.2	0.538
Sri Lanka	3955	25.5	30.9	1361	12.6	10.3	0.757
Tajikistan	520	19.7	20.4	210	5.8	8.7	0.617
Turkmenistan	656	23.9	26.8	224	8.5	9.6	0.678
Uzbekistan	3370	24.0	27.1	1269	9.0	10.6	0.681
Western Asia							
Armenia	1704	102.5	74.1	609	36.7	24.2	0.736
Azerbaijan	1413	23.8	25.4	471	9.9	8.6	0.745
Bahrain	177	27.1	42.5	42	8.2	11.1	0.815
State of Palestine	578	27.5	44.0	223	10.6	18.3	0.684
Georgia	1541	67.7	44.0	530	23.3	13.2	0.755
Iraq	4542	67.7	42.6	1983	11.8	19.3	0.659
Israel	4010	103.0	80.5	990	25.4	17.3	0.891
Jordan	1237	39.4	61.0	426	13.6	21.8	0.737
Kuwait	314	26.9	46.7	103	8.8	17.3	0.796
Lebanon	1934	88.0	78.7	599	27.3	24.0	0.766
Oman	195	25.0	26.0	65	5.5	9.5	0.796
Qatar	148	31.6	46.1	31	6.6	11.2	0.843
Saudi Arabia	2791	36.8	29.5	795	6.2	9.1	0.830
Syrian Arab Republic	4140	39.7	52.5	1623	15.6	21.5	0.635
Turkey	15230	22.8	39.1	5199	13.9	13.4	0.754
United Arab Emirates	568	39.9	39.2	124	5.0	10.5	0.829
Yemen	1963	26.3	27.4	997	7.9	14.9	0.498

TABLE 3. Fraction (%) of all cancer cases (at all anatomical sites), breast cancer and preventable fraction attributable to BMI in Asia in 2012.

Country	Fraction (%) of all cancer cases (at all anatomical sites) attributable to BMI						Fraction (%) of all breast cancer attributable to BMI		Preventable fraction (%)
	Both Sexes		Male		Female				
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	
Eastern Asia									
China	49000	1.7	14000	0.76	36000	3.0	5600	5.3	1.9
Japan	15000	2.2	5800	1.4	9400	3.2	1900	4.5	1.3
Korea, Republic of	4600	2.2	1800	0.8	2800	2.8	579	6.8	3.0
Mongolia	49	1.3	13	0.65	36	1.9	6	10.6	1.7
South-Eastern Asia									
Brunei	15	2.9	4	2.0	10	3.7	3	5.6	0.16
Cambodia	*66*	*0.48*	*6*	*0.09*	*61*	*0.8*	17	2.5	0.0
Indonesia	3600	1.3	481	0.37	3200	2.1	1200	4.1	0.0
Lao PDR	*38*	*0.68*	*4*	*0.13*	*35*	*1.3*	7	3.1	0.0
Malaysia	1100	3.2	308	1.8	810	4.5	290	9.2	5.1
Myanmar	*439*	*0.72*	*43*	*0.15*	*395*	*1.3*	96	3.3	0.0
Philippines	1600	1.8	300	0.76	1300	2.6	560	5.6	0.0
Singapore	521	3.4	154	2.0	376	4.9	120	6.9	0.0
Thailand	2400	2	416	0.69	2000	3.4	610	7.6	3.4
Timor-Leste	*8*	*0.84*	*1*	*0.22*	*7*	*1.5*	2	2.7	0.0
Viet Nam	368	0.31	37	0.06	330	0.65	76	1.3	0.0
South-Central Asia									
Afghanistan	*109*	*0.64*	*12*	*0.16*	*96*	*1.1*	27	1.9	0.0
Bangladesh	249		45	0.08	204	0.35	25	0.48	0.0
Bhutan	3	0.76	1	0.48	2	1.1		3.8	0.0
India	7000	0.73	956	0.22	6000	1.2	2100	2.8	0.0
Iran	2400	3.1	681	1.6	1700	4.7	580	11.8	5.9
Kazakhstan	1700	4.5	353	2.0	1400	6.6	560	12.6	0.0
Kyrgyzstan	189	3.5	29	1.1	160	5.5	45	11.4	0.06
Maldives	*6*	*2.7*	*1*	*0.43*	*5*	*5.1*	3	13.0	7.7
Nepal	*69*	*0.4*	*10*	*0.14*	*59*	*0.61*	9	1.1	0.0
Pakistan	2300	1.7	193	0.35	2100	2.7	970	6.1	2.6
Sri Lanka	283	1.2	26	0.27	257	2.0	150	5.2	0.0
Tajikistan	128	2.6	22	0.96	106	4.1	20	7.0	0.0
Turkmenistan	120	2.2	35	1.3	85	3.0	23	7.8	0.06
Uzbekistan	622	2.2	111	1.3	510	4.4	190	10.2	1.6
Western Asia									
Armenia	580	5.5	71	1.4	510	9.5	171	13.4	1.0
Azerbaijan	336	2.6	81	1.2	255	4.0	109	13.6	0.55
Bahrain	43	5.2	14	3.3	29	7.1	12	14.5	5.7
Georgia	403	3.3	63	1.0	340	5.6	126	11.2	0.0
Iraq	834	3.7	176	1.8	659	5.3	360	14.9	3.2
Israel	1900	6.6	571	3.9	1300	9.5	457	14.3	4.8
Jordan	417	7.2	127	4.5	290	9.9	130	18.1	2.5
Kuwait	107	7.2	30	3.9	77	10.6	34	18.5	4.1
Lebanon	464	5.4	91	2.2	372	8.3	189	15.2	5.8
Oman	50	3.8	17	2.4	33	5.5	12	11.5	3.1
Qatar	45	4.9	20	3.5	25	7.3	9	15.6	2.3
Saudi Arabia	1000	6.8	290	4.0	742	9.2	216	17.3	4.2
Syrian Arab Republic	*1100*	*5.5*	*287*	*3.0*	*802*	*7.7*	391	16.4	
Turkey	6600	4.8	1700	2.1	4900	8.5	1400	16.2	3.5
United Arab Emirates	126	4.8	45	3.4	81	6.3	32	17.3	2.9
Yemen	220	2.5	59	1.5	161	3.3	101	11.0	4.3

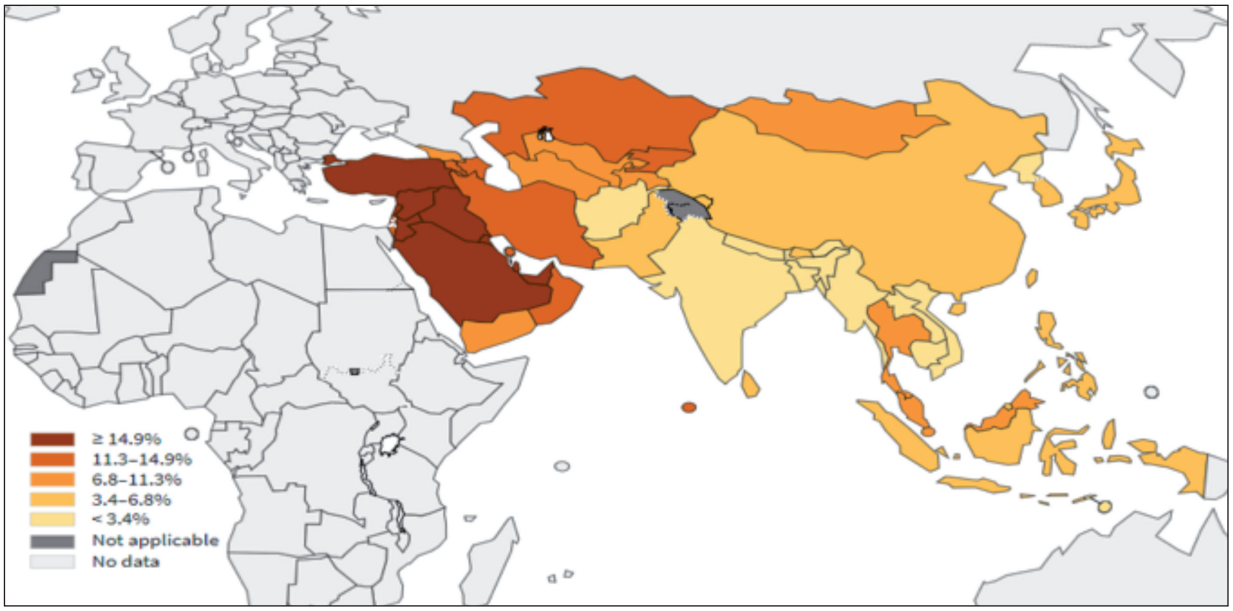


Fig. 2. Fraction (%) of all breast cancer cases attributable to excess BMI among female in Asia in 2012 [Source: GLOBOCAN 2012].

The results of the study showed that there is a positive and significant correlation between the incidence of breast cancer attributable to BMI and HDI; the higher the development index, the higher the incidence of breast attributable to BMI (R= 0.371, $p<0.05$). On the other hand, the results showed that increasing the developmental index increases breast cancer prevention percentage attributable to BMI. There is a positive and significant correlation between the prevention percentage and the developmental index ($p=0.522$, $p<0.05$) (Figure 4).

DISCUSSION

In 2012, a total of 1671149 people (crude rate: 47.8 per 100000) were diagnosed with breast cancer, and 521,907 deaths were reported related to this cancer worldwide (crude rate: 14.7 per 100000), almost half of which occurred in areas with high HDI. The highest cumulative risk belongs to developed countries, including Latin America, Europe and Australia. Breast cancer accounts for about 46% of women's cancers with high and very high HDIs, 29% in areas

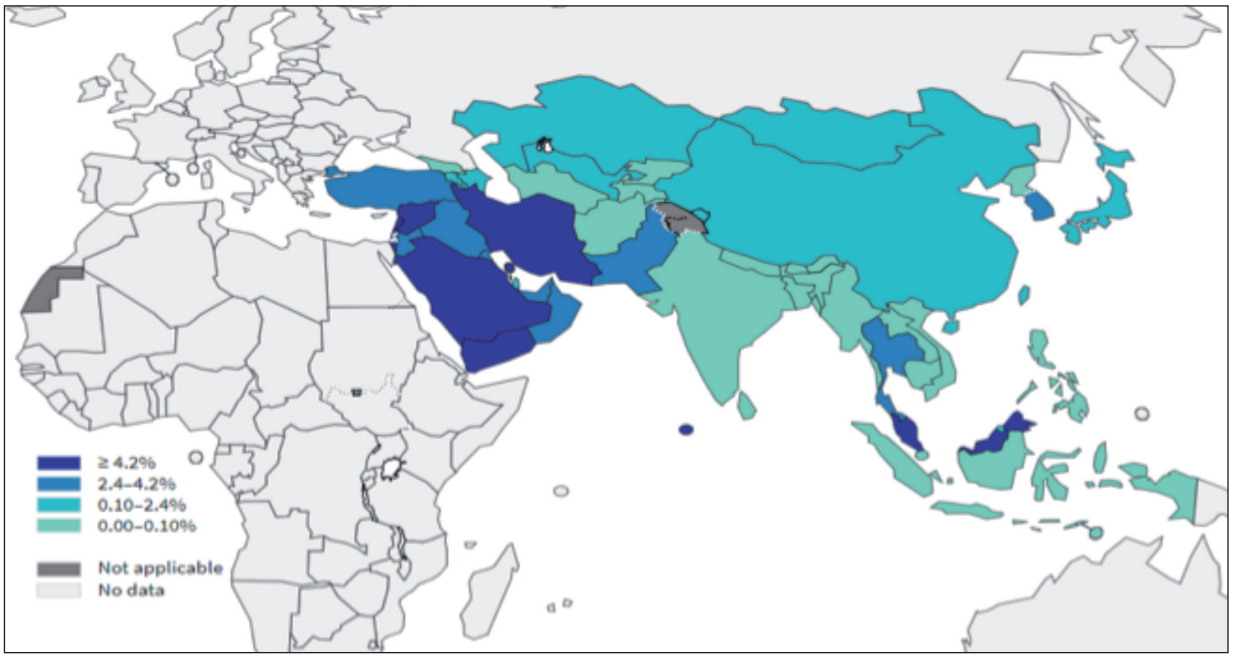


Fig. 3. Preventable fraction (%) breast cancer cases attributable to excess BMI among female in Asia in 2012 [Source: GLOBOCAN 2012].

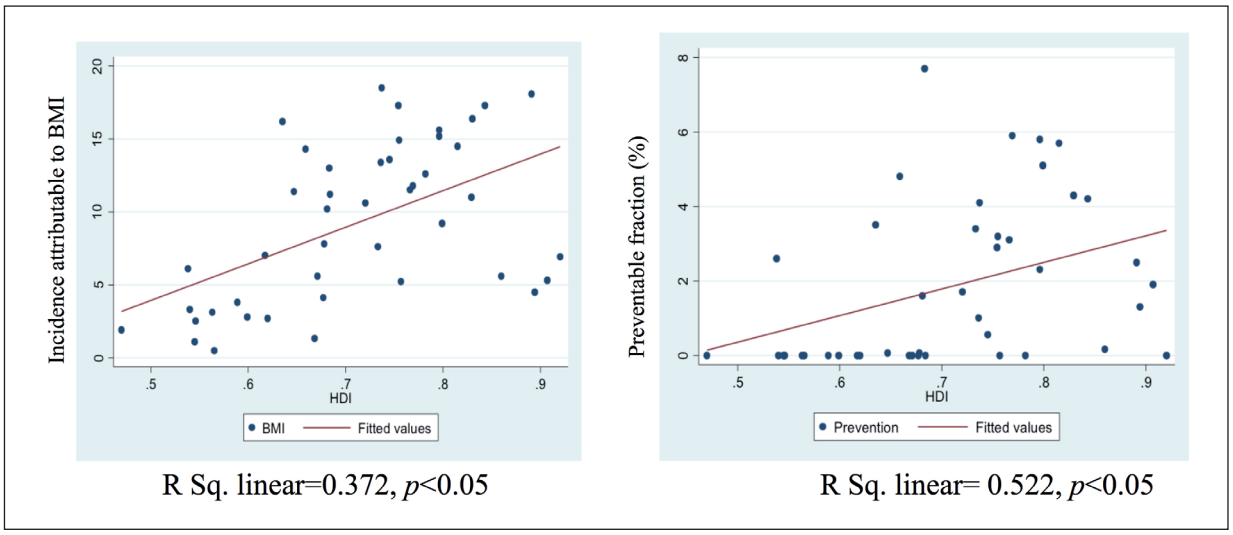


Fig. 4. Correlation between the incidence of breast cancer attributable to BMI and prevention fraction (%) with the HDI in Asia in 2012.

with medium HDI and 9% in areas with low HDI. The standard BC incidence age rate in women from 78 years old (per 100000 women) in areas with high HDI decreased to 26.5 years old (per 100000 women) in areas with moderate HDI. However, the highest percentage of deaths occurred in areas with low and medium HDI. There was a significant correlation between the prevalence of BC and its mortality rate with HDI globally. In addition, the effect of obesity on the incidence of BC and the risk of death in adults is well documented[34]. In 2012, breast cancer was the most common type of cancer in women in the Asia-Pacific region, accounting for 18% of all cancers, and it is the fourth most common cause of cancer deaths (9%) after lung, liver and stomach cancers. Although its incidence rate in New Zealand and Australia was much higher than in other areas, its incidence rate in the Asian countries has increased in recent years. The mortality rate associated with BC is reported differently. Its trend has been ascending in Malaysia and Thailand, steady in Hong Kong and Singapore, and descending in Australia and New Zealand. The highest incidence was observed in China (46%), Japan (14%) and Indonesia (12%). The highest death rates associated with breast cancer (22%) occurred in the Asia-Pacific region with a rate of 8 per 100,000 people. China (41%), Indonesia (17%) and Japan (12%) had the highest death rate for breast cancer[35]. In the current study conducted in 2012, breast cancer was the second most common cancer in women with 1.67 million new cases (25% of all cancers), in more developed countries (794000 cases, 27.9%). Less developed countries (883000 cases, 23%), however, have a higher prevalence. Breast cancer is the fifth leading cause of death from cancer (522000 deaths, 14.7%) and the second leading cause of death from cancer in developed regions (198000 deaths, 15.4%) after lung cancer. It is the first cause of death from cancer in less developed regions (324000 deaths, 14.3%). The highest incidence of breast cancer in Asia was in Israel, Lebanon and Armenia, respectively. The highest mortality rates were for Pakistan, Armenia and Lebanon. There was a positive and significant correlation between the incidence of breast cancer and HDI. There was a negative correlation between mortality rate and HDI, which was not statistically significant. The highest incidence of breast cancer related to BMI was in Kuwait (18.5%), Oman (18.1%) and UAE (17.3%), respectively. The highest preventable percentage of breast cancer attributable to BMI was in the Maldives (7.7%), Iran (5.9%), and Lebanon (5.8%), respectively. There was a positive and significant correlation between the incidence of breast cancer attributable to BMI and HDI index; with the increase in the development index, the incidence of BC attributable to BMI increased. With an increase in the development index, the percentage of breast cancer prevention attributable to BMI is increased, and there was a positive and significant correlation between the percentage of prevention and development index. Morbidity and mortality of cancer types in different parts of the world follow a different pattern and have a relationship with factors such as occupation, society, culture, race, geographical area and nutrition. Meanwhile, the incidence rate of breast cancer is increasing throughout the world. However, in the United States and Europe it is twice higher than in Asian countries[36], and it has a direct relationship with the increase in income of the countries[37]. Lifestyle and environmental factors are other important factors contributing breast cancer[38]. Women in the Asian countries partly adhere to their traditional lifestyle. However, the rapid economic-social advances and cultural changes taking place in these countries should not be ignored.

Of these cases, there may be a decrease in the number of children among the Asian women, pregnancy at a higher age, and a decrease in the duration of breastfeeding[29]. The number of new cases of breast cancer is similar in developed and less developed countries. However, in developed countries, the number of cases detected in the early stages of the disease is much higher[39,40]. The main reason for this is increasing public awareness and using breast cancer screening methods[41]. Asia is one-third of the world (about 32%), and it has a diverse geography, culture and socioeconomic status. As noted, the incidence of breast cancer in the Asian countries is increasing[42], because these countries are struggling with cultural poverty. Thus, they have problem in diagnosing breast cancer at early stages, adopting healthy eating habits, raising awareness to environmental risk factors. Moreover, they are tackling with undesirable changes in reproduction and fertility, uneven distribution of resources including insufficient access to medical care contributing increased life expectancy[43]. These factors have a role to play in increasing breast cancer in urban and younger communities in these countries[44]. The continuation of death from breast cancer in these countries can be linked to economic poverty, as women in these countries often ignore early breast problems due to health costs. They postpone diagnosis and early treatment as a result of low use of breast cancer screening programs. On the other hand, the relationship between breast cancer and high body mass is well acknowledged. Obesity is a chronic disease with negative physical and psychological consequences and is becoming an epidemic[45]. The results of previous studies indicate a 25% increase in breast cancer incidence in overweight or obese and low mobility people. The main mechanism for linking obesity to breast cancer is unknown. However, hormonal changes associated with obesity, especially the increase in estrogen production from adipose tissue, are responsible for this relationship[46]. Overweight and obese people often have inappropriate behavioral patterns and norms, such as having high fat diets, high levels of solid oils, low-gain diets and low mobility, which are among the risk factors contributing to cancer and breast cancer. Consumption of fast-food is also important because of the high amounts of sodium nitrate and its conversion to carcinogens called nitrosamine[47].

CONCLUSIONS

Breast cancer and obesity are multi-dimensional phenomenon, affected by intermediary factors such as age, sex, race, and developmental index. Therefore, it is required to emphasize the early detection and prevention of breast cancer, changes in lifestyle, the risk factors, and trainings needed to increase the awareness of individuals about screening methods for reducing breast cancer.

Conflict of Interest

The authors declare no conflict of interest

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