COSMETIC PRODUCTS DON'T INCREASE THE RISK OF BREAST CANCER: A RETROSPECTIVE CASE-CONTROL STUDY IN SOUTHEAST IRAN

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Abstract – Objective: Breast cancer is the most common cancer among women worldwide. Women often use cosmetics every day. This study aimed to investigate the association between cosmetic products and developing breast cancer.

Patients and Methods: In a retrospective case-control study, 235 patients with breast cancer and 174 healthy women completed a valid questionnaire regarding the usage of cosmetic products (i.e., oxidant, hair color, tattoo, nail polish, lipstick, sunscreen, eye shadow, mascara, cream powder, and deodorant).

Results: The results showed that among different cosmetic products, only use of sunscreen had a protective effect on developing breast cancer (Odds ratio = 0.79, confidence interval = 0.67- 0.93, p-value = 0.006). In addition, the history of chronic disease had a protective effect on developing breast cancer (Odds ratio = 0.28, confidence interval = 0.15- 0.52, p-value < 0.001).

Conclusions: Use of oxidant, hair color, tattoo, nail polish, lipstick, eye shadow, mascara, cream powder, and deodorant were not associated with the risk of developing breast cancer. Use of sunscreen had a protective effect on developing breast cancer. According to the current study, cosmetic products may not increase the risk of breast cancer.

KEYWORDS: Breast, Cancer, Cosmetic, Case-control, Sunscreen/UV protection

INTRODUCTION

Breast cancer (BC) is the most commonly developed cancer in women and the second common cancer throughout the world. The highest age-standardized incidence rates (ASIR) of BC were observed in regions with a very high HDI (ASIR=78.2) like North America, and the highest age-standardized mortality rates (ASMR) were observed in regions with a low HDI (ASMR=17) like Africa[1]. During 2003-2009, ASIR of BC in Iran increased from 15.96 to 28.25 per 100,000 women[2].

Breast cancer etiology is multifactorial[3]. According to the European Union, all exogenous substances may disrupt endocrine if they alter the function of the endocrine system, and cause adverse effects [4]. Exposure to numerous chemical materials in the environment causes either direct or indirect adverse effects[5]. These chemicals are various with daily usages such as cosmetics, detergents, foods, flame retardants, sun solutions, pesticides, plastics, and metal products[6]. Cosmetic products seem to have a potential contribution to cancer[7]. Iran is the third biggest consumer of cosmetics among the middle-east countries[8].

Many believe that cosmetic products will lead to several health problems such as reproductive damage, cancer in males and females, and developmental disorders[9]. Linhart et al[10] suggested that frequent use of aluminum-based cosmetic products might lead to accumulated aluminum in breast tissue and

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overuse of cosmetic products at younger ages might increase the risk of breast cancer. However, Konduracka et al[11] in a systematic review found no significant relationship between cosmetic products and breast cancer. Kaličanin and Velimirović [12] added that cosmetics could have adverse effects on human health because they contain lead, a highly toxic metal. Allam[13] in a systematic review found no significant relationship between the use of deodorants/antiperspirants and the breast cancer. However, further research is needed in this regard.

Latest studies investigating the effect of cosmetic products on breast cancer have shown conflicting results with no reasonable evidence. Therefore, the current study aimed to investigate the association between using cosmetic products and developing breast cancer in the Iranian context.

METHODS AND MATERIALS

Study Design and Setting

This study had a retrospective case-control design. The study settings were educational hospitals affiliated to the Kerman University of Medical Sciences and the Association of Patients with Cancer (Yas). These centers provide specialized care and support to cancer patients in Kerman province, the largest city in southeastern Iran, with a population of more than 722000.

Sampling and Sample Size

Convenience sampling was used to select the participants. The target population was composed by women with breast cancer and those who did not have breast cancer. The control group was selected from the same age group (±2). Of 270 patients with breast cancer, 235 completed the questionnaire, so the response rate for patients was 87%. Of 210 healthy women, 174 ones completed the questionnaire, so the response rate for healthy women was 82.86%.

Measurements

A two-part questionnaire was used to gather information: (a) socio-demographic questionnaire, (b) a researcher-made questionnaire for studying cosmetic products. The socio-demographic questionnaire consisted of age, sex, marital status, level of education, occupation, income, number of children, and other factors. The cancer information questionnaire studied some information such as duration of breast cancer, stage of cancer, type of treatment, drugs, smoking, alcohol consumption, the age of marriage. The researcher-made questionnaire for studying cosmetic products included the usage of cosmetic products, i.e. oxidant, hair color, tattoo, nail polish, lipstick, sunscreen, eye shadow, mascara, cream powder, and deodorant. Each of the products was assessed using a Likert scale. The Liker scales for oxidant, hair color, and tattoo were on the scale value of 1 to 5 (from rarely to more than once per month). The Likert scale for nail polish was on the scale value of 1 to 6 (from rarely to daily). The Likert scales for lipstick, sunscreen, eye shadow, mascara, cream powder, and deodorant were on the scale value of 1 to 7 (from rarely to more than once a day). Therefore, the possible ranges for oxidant, hair color, and tattoo usages were 1-5, the possible range for nail polish usage was 1-6, and the possible ranges for lipstick, sunscreen, eye shadow, mascara, cream powder, and deodorant usages were 1-7. Five faculty members of the school of nursing and midwifery checked the content validity of the questionnaire. The internal reliability and stability of the questionnaire were checked in a pilot study (15 patients and 15 healthy women). The Cronbach alpha was 0.9, and the two-interval correlation coefficient was 0.8.

Statistical Analysis

Participants were asked to complete the self-report questionnaires. In case the participants had been illiterate, the researchers would have completed the questionnaire by interviewing. Inclusion criteria were (1) diagnosed breast cancer and (2) age between 20-65 years old. Exclusion criteria were (1) cognitive impairment and (2) other cancers. Sampling was done from January 2017 to August 2018.

Data were analyzed by SPSS (version 18, SPSS Inc., Chicago, IL, USA). Descriptive statistics (frequency, percentage, mean and standard deviation) were used to describe participants' demographic characteristics and clinical information. Mean and standard deviation were used to describe cosmetic products usages. Chi-square and Mann Whitney U tests were used to compare the study variables between patients with breast cancer and healthy women. Multivariate logistic regression was used to determine the association between significant variables and the risk of developing breast cancer. The significance level of the p-value was considered 0.05.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of Kerman University of Medical Sciences (IR.KMU.REC.1395.421). First, the researcher pro-

TABLE 1. The socio-demographic characteristics of the participants.

Group Variable	Healthy women (n = 174)		Women with breast cancer (n = 235)		Statistical test	p-value
	Frequency	Valid Percent	Frequency	Valid Percent		
Marital status						
Single	10	5.8	12	5.1	$X^2 = 0.44$	0.80
Married	143	83.1	201	85.5		
Divorced & widow	19	11.0	22	9.4		
Living Place						
Inside Kerman	92	53.2	124	52.8	$X^2 = 0.01$	0.93
The villages around	81	46.8	111	47.2		
Number of children						
0	18	10.7	21	8.9	$X^2 = 29.10$	<0.001
1	20	11.8	11	4.7		
2	47	27.8	55	23.4		
3	45	26.6	45	19.1		
4	25	14.8	39	16.6		
5	4	2.4	27	11.5		
≥ 6	10	5.9	37	15.7		
	Mean	SD	Mean	SD		
Age (yr.)	49.49	9.19	48.61	9.02	$t = -0.96$	0.34
Age of first menstrual bleeding (yr.)	13.68	1.71	13.73	1.63	$t = -0.29$	0.77
Duration of marriage (yr.)	24.15	11.31	25.94	12.15	$z = -1.61$	0.11
Age of first delivery (yr.)	20.39	8.05	20.59	8.47	$t = -0.24$	0.81

t = Independent t-test, z = Mann-Whitney U test.

vided some oral information to the participants, including the goals and objectives of the study. In addition, the patients were ensured about data confidentiality and anonymity, and their withdrawal from the study at any time. Individual informed consent was obtained from all participants.

RESULTS

The mean ages of healthy women and those with breast cancer were 49.49 ± 9.19 and 48.61 ± 9.02, respectively. 83.1% of the healthy women and 85.5% of the women with breast cancer were married. 53.2% of the healthy women and 52.8% of the women with breast cancer were living in Kerman City. No differences were found between the two groups in age, marital status, menstrual age, duration of the marriage, the first gestational age, and living place (p-value > 0.05). The number of children was significantly different between the two groups (Table 1). Only alcohol consumption and history of chronic disease were significantly different between the two groups (p-value < 0.05) (Table 2). The healthy women significantly used more cosmetics than those with breast cancer (Table 3). However, the multivariate logistic regression showed that among all important variables (i.e. variables that had a p-value < 0.2 in the univariate analysis), only the use of sunscreen (Odds ratio = 0.79, Confidence interval =

0.67- 0.93, p-value = 0.006) and history of chronic disease (Odds ratio = 0.28, Confidence interval = 0.15- 0.52, p-value < 0.001) had a protective effect on breast cancer (Table 4).

DISCUSSION

The results of the present study showed that among different cosmetics (i.e., oxidant, hair color, tattoo, nail polish, lipstick, sunscreen, eye shadow, mascara, cream powder, and deodorant), only the use of sunscreen was related to the breast cancer. In other words, the use of sunscreen had a protective effect on developing the breast cancer. In addition, among other study variables, the history of chronic disease had a protective effect on developing the breast cancer.

In line with our results, Allam[13] demonstrated no relationship between the use of deodorants/antiperspirants and the breast cancer. Also, Farki et al[14] did not support the effect of cosmetics on the risk of breast cancer. However, Linhart et al[10] examined aluminum-based products and found the harmful effect of cosmetics on the risk of breast cancer in women. Thrasher[15] believed that cosmetic products were based on common ingredients such as retinol, parabens, and even soy. The daily exposure to these potentially toxic materials can lead to hormone imbalances, genotoxic influences, mitotic disruptions, and collagen overproduction.

TABLE 2. The past medical history of the participants.

Group Variable	Healthy women (n = 174)		Women with breast cancer (n = 235)		Chisquare	p-value
	Frequency	Valid Percent	Frequency	Valid Percent		
History of cancer among first-degree relatives						
Yes	34	19.5	61	26.0	2.31	0.13
No	140	80.5	174	74.0		
History of Breast cancer among first-degree relatives						
Yes	12	6.9	18	7.7	0.09	0.77
No	162	93.1	217	92.3		
History of smoking						
Yes	9	5.2	5	2.1	2.80	0.09
No	165	94.8	230	97.9		
History of substance use*						
Yes	5	2.9	8	3.4	0.09	0.76
No	169	97.1	227	96.6		
History of alcohol consumption						
Yes	5	2.9	0	0	6.84**	0.013
No	169	97.1	235	100.0		
History of contraceptive use						
Yes	54	31.0	93	39.6	3.17	0.08
No	120	69.0	142	60.4		
History of using contraception hormone						
Yes	23	13.2	33	14.0	0.06	0.81
No	151	86.8	202	86.0		
History of estrogen consumption						
Yes	29	16.8	25	10.6	3.25	0.07
No	144	83.2	210	89.4		
History of women's diseases						
Yes	52	34.2	54	25.5	3.28	0.07
No	100	65.8	158	75.5		
History of chronic diseases						
Yes	63	48.5	62	27.9	15.1	<0.001
No	67	51.5	160	72.1		

*Opium or any other opium derivatives
**Fisher's Exact Test

TABLE 3. Using cosmetic products among the participants.

Group Variable	Healthy women (n = 174)		Women with breast cancer (n = 235)		Mann-Whitney U test	p-value
	Mean	SD	Mean	SD		
Oxidant	1.42	0.76	1.23	1.30	-3.51	<0.001
Hair color	2.34	1.19	2.10	1.30	-2.38	0.02
Tattoo	1.15	0.52	1.05	0.25	-2.35	0.02
Nail polish	1.44	1.04	1.15	0.58	-3.4	0.001
Lip stick	3.1	2.29	2.01	1.82	-5.12	<0.001
Sunscreen	3.76	2.37	2.24	1.96	-6.62	<0.001
Eye shadow	1.66	1.34	1.29	0.96	-4.19	<0.001
Mascara	1.98	1.67	1.45	1.19	-4.24	<0.001
Cream powder	2.01	1.63	1.34	0.98	-5.26	<0.001
Deodorant	2.44	2.12	1.46	1.32	-5.77	<0.001

TABLE 4. The logistic model of important variables.

Variable	Multi variate logistic regression		
	Odds ratio	Confidence interval	p-value
Duration of marriage (yr.)	0.99	0.97-1.03	0.87
Oxidant	0.95	0.60-1.50	0.83
Hair color	0.96	0.74 – 1.24	0.76
Tattoo	0.67	0.25-1.80	0.43
Nail polish	0.68	0.44-1.07	0.10
Lip stick	1.02	0.83-1.24	0.87
Sunscreen	0.79	0.67-0.93	0.006
Eye shadow	0.99	0.70-1.43	0.98
Mascara	1.23	0.92-1.63	0.16
Cream powder	0.87	0.65-1.16	0.34
Deodorant	0.84	0.7-1.01	0.06
Number of children			
0	1	-	-
1	0.61	0.17-2.21	0.45
2	1.12	0.36-3.48	0.84
3	0.69	0.22-2.34	0.54
4	1.41	0.37-5.34	0.62
5	4.88	0.81-29.32	0.08
≥ 6	1.80	0.38-8.51	0.46
History of cancer among first-degree relatives			
Yes	1	-	-
No	0.66	0.33-1.31	0.23
History of smoking			
Yes	1	-	-
No	2.31	0.53-10.02	0.26
History of alcohol consumption			
Yes	1	-	-
No	0.99	0.001-1.001	>0.99
History of contraceptive use			
Yes	1	-	-
No	0.59	0.38-1.31	0.09
History of estrogen consumption			
Yes	1	-	-
No	0.85	0.33-2.17	0.85
History of women's diseases			
Yes	1	-	-
No	0.71	0.38-1.31	0.71
History of chronic diseases			
Yes	1	-	-
No	0.28	0.15-0.52	<0.001

1 = The reference group

Therefore, breast cancer is a horrible prognosis for most cosmetic-consuming women[15]. Nourmoradi et al[8] reported that the continuous use of these cosmetics could increase the absorption of heavy metals in the body through either swallowing lipsticks or dermal absorption. The effects of heavy metals on women may be harmful. Therefore, effort must be made to inform the users and the general public about the harmful effects of the cosmetic products[8]. In addition, Heikkinen et al[16] suggested that the use of hair dyes was associated with breast cancer incidence. Also, the relationship between safety of hair dyes and breast cancer has not been fully acknowledged yet. Watts et al[17] found that the regular use of sunscreen could prevent the incidence of melanoma among young adults. Also, Berger et al[18] believed that skin care products might be helpful to minimize the impact of secondary cutaneous reactions with radiotherapy as a treatment for patients with breast cancer. Reducing exposure to

sunlight and increasing sun protection can be one of the strategies to prevent skin cancers. The rate of exposure to ultraviolet radiation has a direct effect on cancers. Therefore, it can be justified that this sunscreen protective effect may prevent cells' deformation and further may prevent developing cancer[19]. Iran is one of the biggest consumers of cosmetics in the Middle East, thus, it is necessary to investigate the different impacts of cosmetic products on different aspects of human body.

The present study also showed among the demographic and clinical characteristics, only not having the history of chronic disease had a protective effect on the breast cancer. On the other hand, individuals with a history of chronic disease were at a higher risk of the breast cancer compared to those without the history of chronic disease. Huakang et al[20] reported that chronic diseases contributed to more than one fifth and one third of the cancer risk and mortality, respectively. In addition, Meijers and de Boer[21] reported that the risk factors such as hypertension, diabetes mellitus, obesity, and myocardial infarction might cause cancer in some individuals. On the other hand, it is difficult for individuals with different chronic diseases to adhere to recommendations, and they may not have a healthy lifestyle. These factors may predispose the individuals to cancer.

The study design limitation may lead to such results. On the other hand, a case-control study is susceptible to recall bias. Self-report information may be either incomplete or inaccurate and may differ between cases and controls. Since there are no definitive answers about the involvement of cosmetic products in carcinogenesis, it is recommended that younger women be careful with the use of cosmetics and avoid its excessive use. In addition, the cosmetic ingredients were not assessed in the present study. Therefore, the effects of different cosmetic products with different ingredients were not clear. Further studies are needed to assess the effect of different cosmetic ingredients on cancer.

CONCLUSIONS

The results of the present study showed that the different cosmetic substances (i.e., oxidant, hair color, tattoo, nail polish, lipstick, eye shadow, mascara, cream powder, and deodorant) did not increase the risk of breast cancer in Iranian women. In addition, the use of sunscreen had a protective effect on developing breast cancer. Further studies are suggested to investigate the association between the cosmetic products and the breast cancer in a different population with different study designs, including cohort and longitudinal ones.

CONFLICT OF INTEREST:

The authors declare no conflict of interest

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