Impact of Breast Size and Body Mass Index on the Prevalence of Breast Cancer in the Sulaimaniyah Province of Iraqi Kurdistan

Deman Ahmed Saeed, Ph.D* Anwar Kader Ibrahim Sheikha, Professor**

ABSTRACT

Background: In Iraq, there is no published data regarding the effects of breast size with high body mass index (BMI) on the prevalence of BC among Iraqi Kurdish women. Thus, this study aimed to determine the association between breast volume and BMI concerning the possibility of developing BC.

Patients and Methods: This cross-sectional study was conducted for 400 women diagnosed with BC at Hiwa Hematology/Oncology Hospital in Sulaimaniyah province from 14th February 2021 to 1st June 2022. Breast size with BMI was studied for women who visited the Clinic Department.

Results: The mean ± SD age at early BC detection was 47.33 ± 9.9 years. The majority (70.8%) of patients had a cup size D or larger, while only 12.8% had a cup size A or smaller. In addition, most patients (61.0%) had a ≥90 band size, and only 7.5% had a ≤75 band size. Therefore, large breast size was significantly correlated to the high incidence of BC. Regarding BMI, most participants were obese (62.5%) or overweight (28.5%). There was a significant relationship between high BMI and breast size with BC (P<0.001).

Conclusion: Large breast volume and high BMI are related to an increased prevalence of BC among Kurdish women.

Keywords: Breast cancer, breast size, body mass index, bra size, cross-sectional study.

Practitioner summary: Currently, there is no published data regarding the effects of breast size with high BMI on the prevalence of BC among Iraqi Kurdish women. Thus, we determined that large breast volume and high BMI are related to an increased prevalence of BC among Kurdish women at Hiwa Hematology/Oncology Hospital, Sulaimaniyah, Iraq.

INTRODUCTION

Breast cancer (BC), until today, is the most prevalent cancer diagnosed in females globally, and it is one of the most common forms of malignancies among Iraqi women[1,2]. Moreover, it is one of the prominent reasons for death among women[3,4]. BC incidence continues to rise, although progress has been made over the last decades regarding epidemiological and clinical research. It affects 1 in 20 globally and as many as one women in 8 in developed countries[5,6].

In young patients of the Kurdistan region, similarly to the West and perhaps more than Middle-Eastern countries but dissimilar to the West, the assessed rates dropped obviously in the elderly[7]. At Hiwa hospital, approximately >4000 BC patients were recently registered in the system. In the Kurdistan region of Iraq, the Directorate of Health (DOH) reported 539 women diagnosed with BC from 2006 to 2008[7], while in the United States, 1,806,590 malignance cases and 606,520 deaths from cancer occurred in 2020. Around 64% of BC survivors aged ≥65 years, while younger than 50 were about 7%[8]. In the previous 40 years, BC's detection and treatment have significantly enhanced[9].

Breast size measurement has witnessed a revolution over the past few decades, with most women knowing, buying, and wearing their brassiere, commonly shortened to "bra", as per standard measurements of the breast band and busts[10]. Breast size or bra size is a combination of numbers such as 32, 34, and 36 inches or 10, 12, and 14, which indicates the band size, and a letter such as A, B, and C, which denotes a cup size. While the breast is a three-dimensional (3D) organ, the bra cup size is usually assessed through two simplistic anthropometric measurements: under the bust and over-bust chest circumferences[11].

Correlations between BC incidence and average breast size have been observed according to the level of the population. For instance, Asian women have smaller breasts than Western and have a lower incidence of BC[12]. However, BC risk but not, presumably, mammary gland size of Asian-American women appears to increase relatively rapidly within the first generation migrating to the United States[13]. Body mass index (BMI) is related with BC risk, with reverse effects in premenopausal/postmenopausal women, as a high BMI level is

*   Department of Adult Nursing
         College of Nursing
         University of Sulaimani
         Iraq.
         E-mail: deman.saeed@univsul.edu.iq
**   Senior Consultant Clinical and Lab
         Hematology Department at Hiwa Cancer Hospital
         Anwar Sheikha Medical City
         Ministry of Health, Zargata Hill, Sulaimaniyah, Iraq.

negatively correlated with premenopausal BC danger but positively correlated with postmenopausal BC risk[14].

Many studies have been conducted extensively on breast size as a risk factor for BC, but the outcomes are indecisive. It is common sense that cancer is the function of volume, with bulkier breasts having more chance of harboring a malignancy[15]. Therefore, in this study, we attempted to design a protocol to clarify the assumption and find if Kurdish women's heavier breasts and high BMI are more prone to malignancy in the breast.

PATIENTS AND METHODS

Sample size and study setting: A Cross-sectional study using a non-probability sampling technique was conducted on 400 women diagnosed with BC at Hiwa Hematology/Oncology Hospital, Sulaimaniyah province, Iraqi Kurdistan, from 14th February 2021 to 1st June 2022. This study was mostly done on retrospective patients who visited for follow-up but expanded prospectively to all new patients diagnosed and managed in this center over the upcoming years of the data collection period.

Each woman who visited the Clinic Department at Hiwa Hematology/ Oncology Hospital for follow-up or newly diagnosed BC was eligible to participate in this study. The participation rate was computed by the percentage of females who visited this department. The patient's appointment depended on the patient's situation, the stage of BC, the patient's stability, and the cancer progression. Some visited yearly or every six months, while others saw their specialist doctor every three months to check their health status and ensure that the BC did not become recurrent.

Questionnaire: Data was collected based on a well-structured, self-designed three-part questionnaire. Firstly, the direct interview was made to manage patients' data, including current age, age at admission, residency, occupation, marital status, economic status, and level of education. Secondly, breast size was measured, and finally, the height and weight of patients were measured. Each interview was mainly last from 40 to 60 minutes. Then, any woman who visited Clinic Department at Hiwa Hematology/Oncology had a chance to be recruited for the study.

Measurements: Breast volume, band, and bust sizes were measured using a centimeter (cm) tape. Since women have a pair of breasts and are usually affected by cancer, one is almost always at the privilege of using the non-cancerous breast as a control. Therefore, the researcher physically measured the volume of healthy breasts with a tape measure. The breast measurements were taken while each patient put on a non-padded bra, stood upright, and breathed normally, usually with her arms at her sides, using an anthropometric measuring tape[16]. Measurement of band and bust was done following the United Kingdom and European Standard guidelines for a mastectomy bra. The band size ranged from EU 65 to 120, and the cups size went between AA and G[17].

Band size (Underbust): It was measured under the bust across the patient's ribcage and around the back under the arms[17].

Cup size (Bust): It measured the non-operated side by putting the measuring tape (horizontal and not too tight or loose) at the same level as the patient's nipple, starting from the sternum and stopping at the middle of the patient's back, multiplied by two[17]. The breast volume was calculated based on cup sizes and categorized into "A or smaller", "B", "C", "D or larger"[18]. Bra size was divided into six categories: XS, S, M, L, XL, XXL[19]. These categories depend on band size; large bra size was ≥90 cm, medium bra size was band size 80 and 85 cm, while small bra size was band size ≤75 cm.

Regarding BMI, the specialized nurse measured patients' height (cm) and weight (kg) with the electronic instrument and recorded them in the electronic system. The researcher could access all data related to patients managed at the center. BMI in kg/m² was considered underweight (<18.5), normal (18.5-24.9), overweight (25-30), and obese (≥30) as defined by WHO BMI classification[20].

Inclusion criteria: Female patients aged ≥18 who completed their chemotherapy with no history of other malignancies or psychiatric disorders, were willing to participate, and lived in Sulaimaniyah Governorate were included in this study.

Exclusion criteria: Palliative patients or those with bilateral mastectomy, chest deformity, neo-adjuvant chemotherapy, physical disability, deaf, and paraplegia were not enrolled in this study.

Patient consent: Each woman has taken oral consent as a voluntary participant in this study. Information regarding the survey, its plan, and its objectives have been explained to them thoroughly. Also, participants were informed about the confidentiality of the data, and they were free to leave whenever they desired.

Statistical analysis: The data analysis was completed using Statistical Package for the Social Sciences program, version 21.0 (IBM SPSS, Chicago, USA). Chi-square tests were used to compare the categorical data among participants. Quantitative continuous variables were described by mean and SD (Standard deviation). The statistical significance of the difference in mean among other BMI groups was evaluated using the ANOVA test. P values of 0.05 were used to correlate bra size and BMI to BC.

RESULTS

Four-hundred female participants with BC were enrolled in this study to determine the impact of breast size and BMI on the prevalence of BC in the Sulaimaniyah province, Iraqi Kurdistan. Table 1 shows that the patient's age ranged from 28-84 years (51.24±10.15) at the time of interview and 25-76 years at the time of admission (47.33 ± 9.9). About 78.8% of patients were married, 61.8% lived outside the city, >70% were housewives, and the financial status of 60.8% was equal to expenditure. Regarding the level of education, 36.3% were illiterate, and the least (19.5%) graduated from Institute/University.

Table 1: The socio-demographic features of participants with breast cancer

Variable		Frequency	Percentage
Age (Year)	Mean ± SD		51.24 ± 10.15
	28 - 44	107	26.8
	45 – 64	243	60.8
	65 – 84	50	12.5
Age on admission (Year)	Mean ± SD		47.33 ± 9.90
	25 - 40	111	27.8
	41 - 60	239	59.8
	61 – 76	50	12.5
Marital status	Single	35	8.8
	Married	315	78.8
	Divorced	9	2.3
	Widow	41	10.3
Residential area	City Center	153	38.3
	Outer	247	61.8
Economic status	Income < Exp.	157	39.3
	Income = Exp.	243	60.8

Level of education	Illiterate	145	36.3
	Primary	119	29.8
	Secondary	58	14.5
	Institute or University	78	19.5
Occupation	Employed	85	21.3
	Retired	19	4.8
	Housewife	295	73.8
	Others	1	0.3
Total		400	100.0

Table 2 demonstrates the features of BC. More than two thirds (76%) had invasive ductal carcinoma, while a few (0.5%) had papillary carcinoma. Regarding the stage of cancer, 50.5% of participants were diagnosed with Stage III, 27.0% with Stage II, 21.0% with Stage I, and 1.5% with Stage lV. The majority (97.0%) of participants had no metastasis to other organs. Also, 96.5% had no recurrence of BC. Regarding the type of surgery, 52.8% of patients underwent a radical mastectomy, lumpectomy was done for 34.5% of patients, partial mastectomy was done for 8.0% of participants, and 4.7% did not undergo surgery.

Table 2: Distribution of sample according to features of breast cancer

Features of breast cancer		Frequency	Percentage
Type	Invasive ductal carcinoma	304	76.0
	Invasive lobular carcinoma	31	7.8
	Medullary carcinoma	16	4.0
	Mucinous carcinoma	5.0	1.3
	Paget disease	10	2.5
	Papillary carcinoma	2.0	0.5
	Malignant neoplasm/ unspecified	8.0	2.0
	Ductal carcinoma in situ	18	4.5
	Phyllodes tumor	3.0	0.8
	Adenocarcinoma	3.0	0.8
Stage	T1N0M0 (I)	84	21.0
	T2N0M0 (II)	108	27.0
	T2N1M0 (III)	202	50.5
	T3N2M1 (IV)	6.0	1.5
Metastasis to other organs	Yes	12	3.0
	No	388	97.0
Recurrence	Yes	14	3.5
	No	386	96.5
Type of Surgery	Not done	19	4.7
	Lumpectomy	138	34.5
	Radical mastectomy	211	52.8
	Partial mastectomy	32	8.0
Total		400	100.0

Moreover, Figure 1 illustrates the band size of patients based on under-bust measurements in cm. Most participants (244) had a band size of ≥90 cm, and only 156 had medium and smaller sizes. Large bra size has a positive effect on the occurrence of BC. On the other hand, Figure 2 shows the cup size of patients based on bust measurements in cm. The majority (70.8%) of patients had a cup size D or larger, 9.3% had a cup size C, 7.3% had a cup size B, and only 12.8% had a cup size A or AA. It can be deduced that cup size D or larger significantly affected the higher occurrence of BC for those with A or smaller.
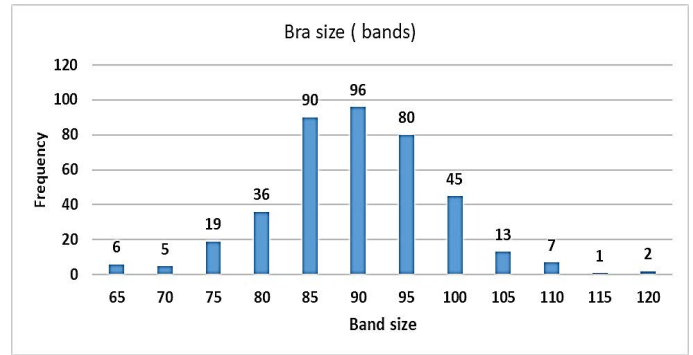

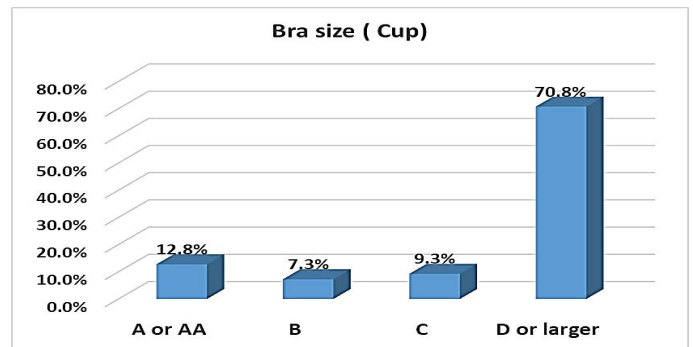**Figure 1:** The band size of patients based on under-bust measurements (cm)

Figure 2: The cup size of patients based on bust measurements (cm)

Furthermore, Table 3 explains bra size for patients based on cup size and band size. The majority (70.8%) of patients had a cup size D or larger, while 9.3% had a cup size C, followed by 7.3% with cup size B, and only 12.8% had a cup size A or AA. Regarding band size, most of the patients (61.0%) had ≥90 band size, 31.5% had medium band size (80-85), and only 7.5% had small (≤75) band size. Therefore, it can be concluded that large breast size significantly affected a higher prevalence of BC than those with A or smaller.

Table 3: Bra sizes of patients based on cup size and band size

Bra Size		Frequency	Percentage
Cup size	A or AA	51	12.8
	B	29	7.3
	C	37	9.3
	D or larger	283	70.8
Band size	Small (≤75)	30	7.5
	Medium (80 - 85)	126	31.5
	Large (≥90)	244	61.0
Total		400	100.0

Additionally, Figure 3 shows cup size of patients based on bust measurements in centimeter and most (283) patients had large cup size (D or larger), while 66 patients had medium cup size (C and B) and only 51 participants had cup size A or smaller. It can be deduced that bra cup size D or larger is associated with higher incidence of BC than women who reported A or smaller. Figure 4 illustrates the bra size of patients based on band size. Again, most (176) of patients had large bra sizes, while only 24 had small ones. Figure 5 presents the BMI groups with the type of BC. The majority (250) of patients were obese, 114 were overweight, 35 were healthy weight, and only one was underweight.

Table 4: Sample distribution according to body mass index with the type of breast cancer.

Type of Breast Cancer	BMI groups				Total	P-value
	Under weight	Normal weight	Over weight	Obese		
Invasive Ductal Carcinoma	1	32	83	188	304	0.99*
Invasive Lobular Carcinoma	0	1	11	19	31	
Medullary Carcinoma	0	1	5	10	16	
Mucinous Carcinoma	0	0	1	4	5	
Paget Disease	0	0	3	7	10	
Papillary Carcinoma	0	0	1	1	2	
Malignant Neoplasm/Unspecified	0	0	1	7	8	
Ductal Carcinoma in Situ	0	1	7	10	18	
Phyllodes Tumor	0	0	2	1	3	
Adenocarcinoma	0	0	0	3	3	
Total	1 (0.2%)	35 (8.8%)	114 (28.5%)	250 (62.5%)	400 (100%)	

* Fisher exact test

Table 5: Relation between body mass index (BMI) and bra cup size of participants

BMI (Kg/m²)	Bra size (Number, Percentage)				Total	P-value
	A or smaller	B	C	D or larger		
<18.5	1.0 (2.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.0 (0.5)	<0.001*
18.5 - 24.99	13 (25.5)	6.0 (20.7)	5.0 (13.5)	20 (7.1)	43 (10.8)	
25.0 - 29.99	19 (37.3)	12 (41.4)	10 (27.0)	95 (33.6)	136 (34.0)	
≥30	18 (35.3)	11 (37.9)	22 (59.5)	168 (59.4)	219 (54.8)	
Total	51 (100)	29 (100)	37 (100)	283 (100)	400 (100)	

Figure 3: Cup size based on bust measurements (cm)
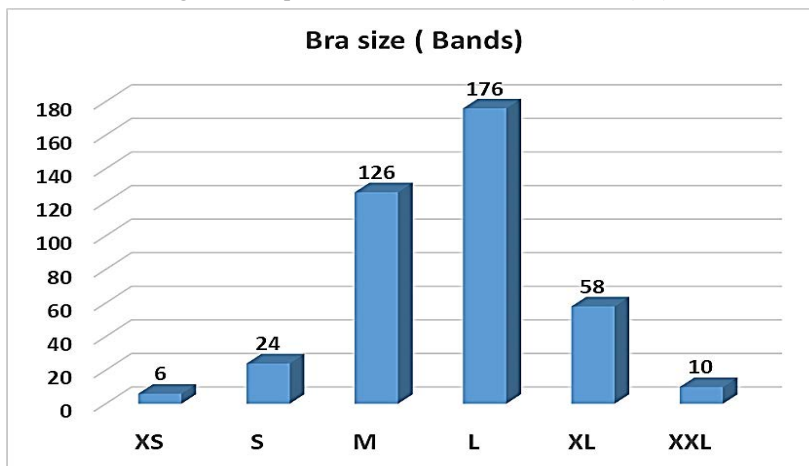

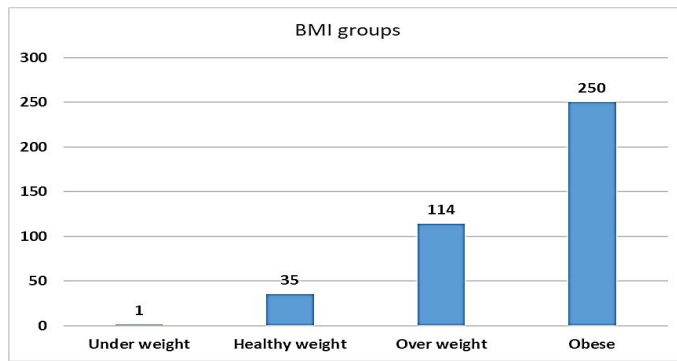**Figure 4:** Patients bra size based on band size

Figure 5: Body mass index (BMI) distribution among patients

Consequently, Table 4 explains the BMI groups with the type of BC. The majority (62.5%) of patients were obese, 28.5% were overweight, 8.8% were normal weight, and only 0.2% were underweight. There is no significant association between BMI groups and types of BC (P=0.99) as majority of the participants (>75%) were from one cancer type. Finally, Table 5 displays the relation between BMI and bra sizes and the BMI is significantly correlated with bra size (P<0.001). However, a correlation between BMI and BC cannot be found in this cross-sectional study (it can be found in case control study).

REFERENCES

1. Al-Kafajy M. Breast Cancer Risk Trends of Iraqi Women. *Med Legal Update* 2020;20(1):383-6.
2. AL-Safi AMH, GhalibYassin BA, AL-Tameemi EA. Body Mass Index among Women with Proved or Suspected Breast Cancer Attending National Center for Early Detection, Baghdad Teaching Hospital. *(IOSR-JDMS* 2015;14(5):1-7.
3. Ghazi H, Baobaid MF, Hasan TN, et al. Awareness and Belief Regarding Breast Cancer Among Women Living in Selangor, Malaysia. *Malay J Pub Heal Med* 2020;20(1):30-9.
4. Momenimovahed Z, Salehiniya H. Epidemiological characteristics of and risk factors for breast cancer in the world. *Breast Cancer: Targets Ther* 2019;11:151.
5. Britt KL, Cuzick J, Phillips K-A. Key steps for effective breast cancer prevention. *Nat Rev Cancer* 2020;20(8):417-36.
6. Łukasiewicz S, Czeczelewski M, Forma A, et al. Breast Cancer—Epidemiology, Risk Factors, Classification, Prognostic Markers, and Current Treatment Strategies—An Updated Review. *Cancers* 2021;13(17):4287.
7. Majid RA, Mohammed HA, Saeed HM, et al. Breast cancer in kurdish women of northern Iraq: incidence, clinical stage, and case control analysis of parity and family risk. *BMC Women's Health* 2009;9(1):1-6.
8. Miller KD, Nogueira L, Mariotto AB, et al. Cancer treatment and survivorship statistics, 2019. *CA: a Cancer J Clinicians* 2019;69(5):363-85.
9. Wang K, Sun J-Z, Wu Q-X, et al. Long-term anti-inflammatory diet in relation to improved breast cancer prognosis: a prospective cohort study. *NPJ Br Can* 2020;6(1):1-11.
10. Chung M, Elie R, Haslett G. Ergonomic Brassiere and Sizing System. FAMU-FSU College Of Engineering: Industrial & Manufacturing Engineering Department, 2016.
11. Coltman CE, Steele JR, McGhee DE. Breast volume is affected by body mass index but not age. *Ergonomics* 2017;60(11):1576-85.
12. Yap Y-S, Lu Y-S, Tamura K, et al. Insights into breast cancer in the east vs west: a review. *JAMA Oncol* 2019;5(10):1489-96.
13. Franceschi S. Breast size, breast reduction, and cancer risk. *Cancer Causes & Control* 1997;8(2):125-6.
14. Harris HR, Tamimi RM, Willett WC, et al. Body size across the life course, mammographic density, and risk of breast cancer. *Am J Epidemiol* 2011;174(8):909-18.
15. Lim LY, Ho PJ, Liu J, et al. Determinants of breast size in Asian women. *Sci Rep* 2018;8(1):1-9.
16. McGhee DE, Steele JR. Breast volume and bra size. *Int J Cloth Sci Technol* 2011;23(5):351-60.
17. https://www.oncovia.com/blog/en/expert/how-to-measure-for-a-mastectomy-bra/.
18. Kusano AS, Trichopoulos D, Terry KL, et al. A prospective study of breast size and premenopausal breast cancer incidence. *Int J Br Can* 2006;118(8):2031-4.
19. https://www.amoena.com/global/about-us/lingerie-and-swimwear-measuring-guide/.
20. Karim SAM, Ghalib HHA, Fattah F, et al. Height, weight, and body mass index association with breast cancer risk in Iraqi Kurdish women. *Case Study Surg* 2015;1(1):1-7.
21. Jansen L, Backstein R, Brown M. Breast size and breast cancer: a systematic review. *J Plast Reconstr Aesthet Surg* 2014;67(12):1615-23.
22. McGhee DE, Steele JR, Zealey WJ, et al. Bra–breast forces generated in women with large breasts while standing and during treadmill running: Implications for sports bra design. *App Ergonomics* 2013;44(1):112-8.
23. White J, Mills C, Ball N, et al. The effect of breast support and breast pain on upper-extremity kinematics during running: implications for females with large breasts. *J Sports Sci* 2015;33(19):2043-50.
24. Williams PT. Breast cancer mortality vs. exercise and breast size in runners and walkers. *PloS One* 2013;8(12):e80616.
25. Ameen HAM, Abdullah H. Allred Score Directly Associated To Body Mass Index In Kurdish Premenopausal Women With Breast Cancer. *JSMC* 2018;8(3):181-7.
26. Hopper JL, Dite GS, MacInnis RJ, et al. Age-specific breast cancer risk by body mass index and familial risk: prospective family study cohort (ProF-SC). *Br Can Res* 2018;20(1):1-11.
27. Shawon MSR, Eriksson M, Li J. Body size in early life and risk of breast cancer. *Br Can Res* 2017;19(1):1-11.
28. Feigelson HS, Bodelon C, Powers JD, et al. Body mass index and risk of second cancer among women with breast cancer. *JNCI* 2021;113(9):1156-60.

29. Hall HI, Coates RJ, Uhler RJ, et al. Stage of breast cancer in relation to body mass index and bra cup size. *Int J Cancer* 1999;82(1):23-7.

30. Hansson E, Manjer J, Ringberg A. Reliability of plastic cups to measure breast volume. *J Plastic Surg Hand Surg* 2014;48(4):254-8.

31. Kayar R, Civelek S, Cobanoglu M, et al. Five methods of breast volume measurement: a comparative study of measurements of specimen volume in 30 mastectomy cases. *Breast Cancer: Basic Clin Res* 2011;5:BCBCR. S6128.