

# ADDITIONAL COST OF OVERWEIGHT IN MEDICATION OF CANCER PATIENTS

## KANSER HASTALARININ İLAÇLA TEDAVİSİNDE FAZLA KİLONUN EK MALİYETİ

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### ABSTRACT

**Introduction:** Overweight refers to a weight above the normal range. Body mass index (BMI) is defined as weight in kilograms divided by the square of height in meters. It is widely accepted in the determination of underweight, normal weight, overweight, and obesity. Cancer is the most common cause of death in the world after cardiovascular diseases, and drug costs in cancer treatment bring a significant economic burden even in developed countries. In our study, we calculated the annual additional cost of patients who were dosed according to kilograms and received intravenous therapy agents only in Eskisehir City Hospital in 2021.

**Methods:** Targeted drugs that received treatment within the 2021 calendar year, whose drug dose was calculated according to body weight, and which were used intravenously, were included in our study. BMI was calculated in the study. Excess weight was recorded in kilograms, with a BMI of 25 and above, with an upper limit of 25. There were 185 patients in total, 129 of them were female (69.7%) and 56 (30.3%) were male.

**Results:** A total of 185 patients, 129 (69.7%) women and 56 (30.3%) men, were included in the study. The median weight of the participants was 71 kg (40-122 kg). In 2021, our hospital paid a total of 4,450,673 Turkish liras for the six drugs we took in our study, and a total of 598,714 Turkish liras were paid due to being overweight.

**Conclusion:** Obesity, like cancer, is one of the leading health problems of today, affecting all age groups. The additional cost of obesity to the health system is known. In this study examining the cost of obesity in cancer treatment, it was found that there was an increase in drug consumption due to weight. It is clear that more efforts are needed for the prevention and treatment of obesity.

**Keywords:** Cancer, Obesity, Targeted therapy, Cost

### ÖZET

**Giriş:** Fazla kilo, normal aralığın üzerindeki bir ağırlığı ifade eder. Vücut kitle indeksi (VKİ), kilogram cinsinden ağırlığın metre cinsinden boyun karesine bölünmesiyle tanımlanır. VKİ, zayıf, normal kilolu, fazla kilolu ve obezitenin belirlenmesinde yaygın olarak kabul görmektedir. Kanser, dünyada kardiyovasküler hastalıklardan sonra en yaygın ölüm nedenidir ve kanser tedavisinde ilaç maliyetleri gelişmiş ülkelerde bile önemli bir ekonomik yük getirmektedir. Çalışmamızda 2021 yılında sadece Eskisehir Şehir Hastanesinde kiloya göre dozlanan ve damardan hedefe yönelik tedavi ajanları alan hastaların yıllık ek maliyetini hesapladık.

**Yöntemler:** 2021 takvim yılı içinde, dozu vücut ağırlığına göre hesaplanan ve intravenöz tedavi kullanılan hedefe yönelik ilaçlar çalışmamıza dahil edildi. Çalışmada VKİ hesaplandı. VKİ 25 ve üzeri hastaların fazla kiloları, üst sınır 25 kabul edilerek kayıt edildi. Çalışmadaki 185 hastanın 129'u (%69,7) kadın, 56'sı (%30,3) erkektir.

**Bulgular:** Çalışmaya 129 (%69,7) kadın ve 56 (%30,3) erkek olmak üzere toplam 185 hasta dahil edildi. Katılımcıların ortalama ağırlığı 71 kg (40-122 kg) idi. 2021 yılında hastanemiz çalışmamızda kullandığımız altı ilaç için toplam 4.450.673 TL, kilo fazlalığı nedeniyle toplam 598.714 TL ödeme yapmıştık.

**Sonuç:** Obezite, kanser gibi bütün yaş gruplarını etkileyen ve günümüzün önde gelen başlıca sağlık sorunlarından biridir. Obezitenin sağlık sistemine getirdiği ilave maliyet bilinmektedir. Obezitenin kanser tedavisinde oluşturduğu maliyeti inceleyen bu çalışmada ilaç tüketiminde kilo sebebi ile artış olduğu bulunmuştur. Obezitenin önlenmesi ve tedavisi için daha fazla çabaya ihtiyaç olduğu açıktır.

**Anahtar kelimeler:** Kanser, Obezite, Hedefe yönelik tedavi, Maliyet

### INTRODUCTION

The medical community has been aware of the mortality and morbidity associated with overweight or obesity for more than 2000 years (1). Overweight refers to a weight above the "normal" range. Body mass index (BMI) is calculated by dividing weight in kilograms by the square of height in meters. It is widely accepted in the determination of underweight, normal weight, overweight, and obesity.

Among adults, overweight is defined as a BMI of 25.0 to 29.9, and obesity as a BMI of 30 or more (2). Obesity can

be further divided into class 1 (BMI, 30.0 to 34.9), class 2 (BMI, 35.0 to 39.9), and class 3 (BMI,  $\geq$ 40.0). Among adults, being obese is linked to a significant decrease in life expectancy, particularly for individuals under 40 years old (3). There is a suggestion that the continuous rise in life expectancy observed in the last two hundred years might be reaching a halt due to the growing prevalence of obesity (4). In general, higher BMI is linked to a rise in all-cause and cardiovascular mortality (5).

In 2015, it is believed that obesity played a role in causing

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approximately four million deaths globally, and in the United States alone, it was associated with over 320,000 deaths in 2014 (6).

In a meta-analysis of 230 cohort studies involving more than 30 million individuals, both obesity and overweight were associated with an increased risk of all-cause death (7). Obesity has surpassed smoking as the primary contributor to preventable diseases and disabilities (8). More than 230 comorbidities and complications of obesity have been identified, and weight loss will improve most of them (9).

Carrying excess weight is linked to a higher likelihood of developing 13 different types of cancer (10). It is estimated that overweight and obesity were responsible for 40% of all cancer cases in the United States in 2014 (11). The likelihood of developing cancer in adulthood is heightened by childhood obesity (12). Furthermore, obesity and excess weight can heighten the probability of experiencing fatal outcomes due to cancer (13).

After cardiovascular diseases, cancer stands as the leading cause of death globally, and drug costs in cancer treatment bring a significant economic burden even in developed countries. Although the cost of conventional chemotherapeutic drugs is relatively low, every unit of drug used due to overweight is extremely important due to the high cost of newly developed drugs.

In our study, we calculated the annual additional cost of patients who were dosed according to kilograms and received intravenous targeted therapy agents only in Eskişehir City Hospital in 2021. The additional cost of a single oncology center in this patient group will give us an idea about the country in general.

## MATERIALS AND METHODS

In our study, the records of patients over the age of 18 who had solid organ tumors, whose treatments were administered intravenously, with a BKI of 25 and above, and who received at least one dose of treatment in our unit within 2021 were retrospectively scanned. Intravenous targeted drugs whose drug dose varies according to body weight were included.

Patients under 18 years of age, whose drug dose was fixed regardless of body weight, who took immunotherapeutic or conventional chemotherapeutic drugs, and orally administered drugs were excluded.

## Statistics

SPSS version 22.0 was used for statistical analysis and descriptive statistics were used in the study population. Two-way ANOVA and chi-square tests were used. Statistical significance was set at  $p < 0.05$ .

## RESULTS

There were 185 patients in total, 129 of them were

female (69.7%) and 56 (30.3%) were male. The median age was 58 years (26-90 years), the median height was 162 cm (142-187 cm), the median weight was 71 kg (40-122 kg), and the median BMI was 27 kg/m<sup>2</sup> (13- 47 kg/m<sup>2</sup>). The classification of the patients according to the drugs they use and their body mass indexes are shown in Table 1.

Among the patients, there were 2 patients with a body mass index of 40 and above, 11 patients between 35-40, 31 patients between 30-35, 64 patients between 25-30, 64 patients between 20-25, and 13 patients below 20. Of the patients, 108 (58.3%) were overweight and 44 (23.7%) had obese. There were at least 3 and no more than 58 kilos of excess.

Of the patients, 55 (29.7%) were receiving treatment for adjuvant/neoadjuvant, and 130 (70.3%) were patients with metastatic disease. A total of 4,450,673 Turkish liras were paid for these 6 drugs in 2021. A total of 598,714 Turkish liras were spent due to being overweight (Table 2).

## DISCUSSION

In our study, trastuzumab, bevacizumab, cetuximab, panitumumab, aflibercept, and trastuzumab emtansine, which is one of the oncology centers in the Republic of Turkey, are included in the targeted drug group used in the oncology clinic of Eskişehir City Hospital, the drug dose is calculated according to the patient's body weight, and administered intravenously. We calculated the cost of aflibercept and the ratio of drugs used for overweight to cost and total drugs used.

In the last quarter century, scientific developments have also been reflected in oncology. It has led to the development of better tools for diagnosis and targeted therapies. During this period, the incidence of many cancers decreased and survival increased (14) The average expenses associated with treating prevalent cancers have risen as a result of advancements in diagnostic technologies and the development of novel medications (15).

In 2021, our hospital paid a total of 4,450,673 Turkish liras for the six drugs we took in our study, and a total of 598,714 Turkish liras were paid due to being overweight. In our country, the net minimum wage in 2021 was 2850 Turkish lira. The total price paid for 6 drugs corresponded to the minimum wage of 1561, and the wage paid for overweight was equal to 210 minimum wages. 12.6% of trastuzumab, 8.4% of bevacizumab, 17.7% of cetuximab, 10.1% of panitumumab, 16.4% of trastuzumab emtansine, and 8.0% of aflibercept were used due to overweight. Moreover, only 29.7% of the total drug used was used for adjuvant or neoadjuvant curative purposes and 70.3% was used for palliative purposes.

Two types of costs are associated with the treatment of obesity and obesity-related conditions: first, direct costs, which are costs from outpatient and inpatient care,

**Table 1.** Characteristics of the patients.

Drug name	Number of patients (n)	Adjuvant/ Neoadjuvant (%)	Metastatic (%)	Excess weight (kilograms)	Total drug used (milligrams)	Medication used for overweight (milligrams)	Percentage of total drugs used for overweight	Fee for medicine (Turkish lira)	The fee paid for the medicine used due to being overweight (Turkish lira)
Trastuzumab	86	63,9	36,1	9(0-37)	272.346	34.476	12.6	1.205.454	151.887
Bevacizumab	64	0	100	6(0-58)	186.272	15.672	8.4	818.894	68.787
Cetuximab	13	0	100	4(0-14)	12.609	2.233	17.7	1.318.910	233.447
Panitumumab	8	0	100	5(0-16)	4.632	468	10.1	397.762	40.173
Trastuzumab emtansine	6	0	100	14(0-26)	3.925	645	16.4	567.226	93.025
Aflibercept	8	0	100	5(0-15)	5.133	413	8.0	142.424	11.393

**Table 2.** Examination of the drugs used based on milligrams and amounts.

Drug name	Number of patients (n)	Female (n)	Male (n)	Age	Height (cm)	Weight (kg)	Body mass index (kg/m <sup>2</sup> )
Trastuzumab	86	100	0	56(26-90)	158(142-176)	70(45-100)	28(18-41)
Bevacizumab	64	43,1	56,9	60(26-85)	164(144-187)	70(40-122)	26(13-47)
Cetuximab	13	15,4	84,6	59(43-68)	169(150-185)	71(50-88)	25(20-30)
Panitumumab	8	37,5	62,5	57(42-73)	166(153-178)	68(47-95)	24(17-31)
Trastuzumab emtansine	6	100	0	60(55-68)	156(149-162)	76(65-84)	31(26-36)
Aflibercept	8	62,5	37,5	65(55-83)	164(144-182)	68(48-77)	25(19-32)

laboratory, radiological examinations, and drug therapy. The second is indirect costs, which are defined as resources forgone due to a health condition(16).

Based on a particular estimation, the United States (USA) allocated approximately \$190 billion towards healthcare expenses associated with obesity in the year 2005 (17). Researching the cost of obesity at the individual level by Finkelstein et al. in 2006, discovered that the cost of per capita medical expenditure for obese individuals is 42 times higher than the cost of medical expenditure for individuals with normal weight (18). Thompson and his colleagues reached the conclusion that the lifetime expenses per capita caused by obesity are comparable to those caused by smoking (19).

In addition to the psychological effects of cancer, the cost of diagnosis, treatment, and complications is an important economic burden. In 2018, the expenditure on medical care for the 15 most prevalent cancer types in the United States surpassed \$156 billion (20).

In our study, we found that even the additional cost of certain drugs due to being overweight can be very important in a specific patient group. Especially when the cost of new generation targeted drugs and the economic situation of the countries are taken into account, even every extra unit of the drug becomes important. Our study draws attention to the economic aspects of both cancer and obesity. Even the price paid for only certain drugs in a single center shows us the economic burden of cancer.

Although our study is single-centered and has limitations such as taking certain drugs, it is the first study we have reviewed in the literature. The fact that it deals with different aspects of obesity and cancer, which are in close relationship with each other, and gives an idea about the country in general, makes our study valuable.

**CONCLUSION**

As a result, in this study, even the additional cost of a hospital with a single medical oncologist in this patient group reminds us again of a more important public health reality of obesity than anticipated. Obesity, like cancer, is a very important condition that needs to be tackled both in terms of medical and financial aspects. More efforts are needed for the prevention and treatment of obesity.

**Ethics Committee Approval:** Ethics committee approval was obtained from Eskişehir Osmangazi University, Non-Interventional Clinical Research Ethics Committee Presidency with the date of 22.03.2022 and 51 decision number.

**Informed Consent:** The study was done retrospectively.

**Authorship Contributions:** Idea/Concept: MÜ, YYÜ, Design: MÜ, YS, Supervision: FT, Data Collection or Processing: MÜ, SG, Analysis or Interpretation: MÜ, YYÜ, Literature Search: MÜ, AU, FT, Writing: MÜ, YS, YYÜ,

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**Conflict of Interest:** No conflict of interest was declared by the authors.

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