

# RESEARCH ON CANCER AND CANCER RISK FACTORS IN THE BLACK SEA REGION

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## **THE NUCLEAR REACTOR ACCIDENT AT CHERNOBYL AND ITS INFLUENCES ON TURKEY**

The world learnt on April 30, 1986, 4 days after the accident occurred in the 4<sup>th</sup> unit of the Chernobyl Nuclear Reactor in the Chernobyl Nuclear Power Reactor near the city of Kiev, Ukraine in the early morning hours on April 26, 1986 that huge amounts of nuclear substances were released into the atmosphere. The radioactive release caused by the accident moved towards the south and central regions of Scandinavia because of the winds blowing in the north-west direction on April 28 and on May 3 Saturday the air mass loaded with fusion substances affected the most parts of Europe as well as Thrace via Bulgaria and Greece. The air mass that drifted from Chernobyl towards the east by a second release reached the northeast coasts of Turkey by passing through the north of Crimean Peninsula and the Black Sea. The most significant reason for a country to be exposed to radioactive contamination is the rain fall in the country under its effect, while the clouds are passing through. With the rains about which the late singer Kazım Koyuncu once said: “These were the rains that fell on our heads”, the radioactive release was commonly felt in the Thracian and Eastern Black Sea regions of Turkey where it rained heavily. Fortunately, owing to the then atmospheric conditions and the directions of the prevailing wind, this effect did not have a balanced dispersion. The fact that Turkey was affected by the disaster less than the European countries can be understood better, given the fact that the transfer in the atmosphere of the radioactive cloud caused by the Chernobyl accident took a 10-day-period, that the cloud concentration rather thinned within this period, and that it moved in the upper layers of the atmosphere. It was great luck for the majority of the regions of Turkey not to be influenced too much by the most disastrous reactor accident ever happened in the world. The measurements made have proved that the effect to which the Turkish people were exposed because of the Chernobyl accident is trivial when compared to that of caused by the natural radiation in the region they live in. In fact, the radiation dose received by the people living in Thrace and Eastern Black Sea region in those days is 59 millirem, which is approximately the dose received in one lung radiography, while the measured radiation dose received by people living in other regions is 50 millirem. In Turkey, where the effects of the accident were felt respectively at a lesser level, almost all agricultural products, including tea, all imported foods and animal feed and all goods that may constitute additional risk for the Turkish people through respiration or digestion were checked thoroughly for radioactive contamination. However, certain official statements, which do not remind

us good memories, which overstep the line, and which serve only to prevent panic, has created the impression that the issue is being covered up even today. Whereas, a control program prepared about tea, which is an indispensable habit of most of the Turkish people, has escaped people's attention. Even though everybody was of the same opinion that it was not scientifically harmful for health in accordance with this control program, merely for avoiding speculative comments and risking a great economic loss, 58.000 tons of tea was destroyed. Without facing any problem and being subjected to all kinds of control and inspections, the other most significant products of the Eastern Black Sea region, hazelnut and tobacco, were and are still being sorted out according to their activities and exported to countries that impose different limits in their import activities, primarily to the EU and the USA. Chernobyl Nuclear Accident has become a turning point for the world in many respects. In the years following the accident, many lessons in adopting a definite position on similar emergency issues and taking related measures in Turkey have been learnt as it is in many countries of the world. (2)

However, Chernobyl's effects that caused economic, social and political problems in Turkey as well as throughout the world are still continuing in spite of the years that have passed. As a matter of fact, great worry has prevailed among our citizens living in the region for the 20 years after the accident. The reason for this worry is the common belief that there has been an increase in the cancer cases in the region after the Chernobyl disaster.

In parallel with the increase in the civilization level, cardiovascular diseases and cancer has become the primal diseases that threaten human life in the developed societies. Cancer, which took the 4<sup>th</sup> place in the 1970s among deaths the reason of which are known, has climbed to the 2<sup>nd</sup> place, right after cardiovascular diseases in the recent years. The projections made show that cancer will take the first order in the entire world in 2030 with an incident rate of 20 millions and a mortality rate of 12 million deaths. Yes, cancer increases in the Black Sea region but it is just as much as it increases in the world and in other parts of Turkey. The major reasons for this increase are as follows:

- Prolonged life expectancy and increase in the old age percentage in the population
- Increase in the consumption of tobacco and tobacco products
- Decrease in contagious diseases and the related number of deaths
- Malnutrition and the increase in life habits
- Increase of the significance of environmental carcinogens
- Obtaining realistic results owing to the improvement in our recording system.

Consequently, a "Research on Cancer and Cancer Risk Factors in the Black Sea Region" was carried out upon the proposal of the National Cancer Advisory Board and the approval of the Ministry, dated September 16, 2005 number 1369, under the coordination of the

Department of Cancer Control in order to find out if there is really an effect that creates such unrest and to observe the probable radiation impacts.

### **Components of the Research on Cancer and Cancer Risk Factors in the Black Sea Region**

- Cancer frequency registry study
- Household members' cancer risk, patient load and cancer awareness research
- Molecular genetic studies in thyroid cancer
- Measurement of radiation load (determination of biological dose)

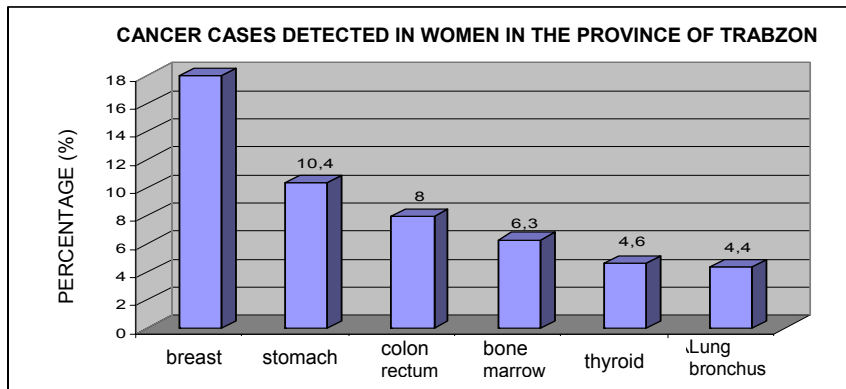
### **Results of the Cancer Frequency Registry Research**

**Participants of the Research:** Dr. Mustafa HAKYEMEZ (Trabzon Coordinator of Provincial Cancer Control Division), Dr. Sultan ESER YALÇIN (İzmir Provincial Health Directorate), Dr. Okan KARAOĞLANOĞLU (Samsun Provincial Health Directorate), Dr. Ayşegül DOĞAN (Edirne Provincial Health Directorate), Nurse Neşe ERDURAN (Trabzon Provincial Health Directorate), Nurse Fatma YANIK ŞAHİN (Trabzon State Hospital), Nurse Özgül ALBAYRAK (Trabzon Numune Hospital), Nurse Özlem AKDOĞAN (Pulmonary Diseases Hospital of Trabzon), Nurse. Ayşe ÇOLAK (Health Care Center in Araklı / Trabzon), Ahmet KARAGÜZEL (Health Care Center in Vakıfkebir Yalıköy / Trabzon), Midwife Çağlayan CANDAN (Health Care Center No2 in Samsun), Nurse İlknur YAPRAK (Health Care Center No3 in Samsun), Midwife Kebire SARAÇ (Health Care Center No4 in Samsun), Midwife Türkan BİLGİN (Health Care Center No5 in Samsun), Midwife Şükriye KARABULUT (Health Care Center No6 in Samsun), Nurse Emel SEZER (Edirne State Hospital), Midwife Gülay DURAN (Edirne State Hospital), Sanitary Servant Vedat USTA (Keşan State Hospital) and the officials working in the Department of Cancer Control in the Ministry of Health of the Turkish Republic.

Within the framework of this study, expert officials on the subject matter have scanned the archives of the regional hospitals and collected cancer data of the last decade. The accumulated data were compared with those of the Turkish cancer registry center, which is a member to the Middle East Cancer Consortium (MECC).

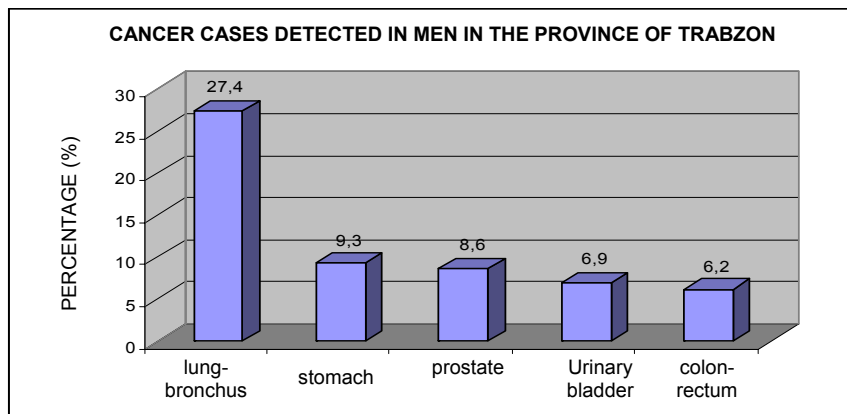
According to the data obtained from the archives of the hospital in Trabzon:

For women, the percentage is 18% for breast cancer, 10.4% for Stomach Cancer, 8.0% for colon-rectum cancers, 6.3% for bone marrow, 4.6% for thyroid gland, 4.4% for Lung-bronchus cancers (Graph 1)



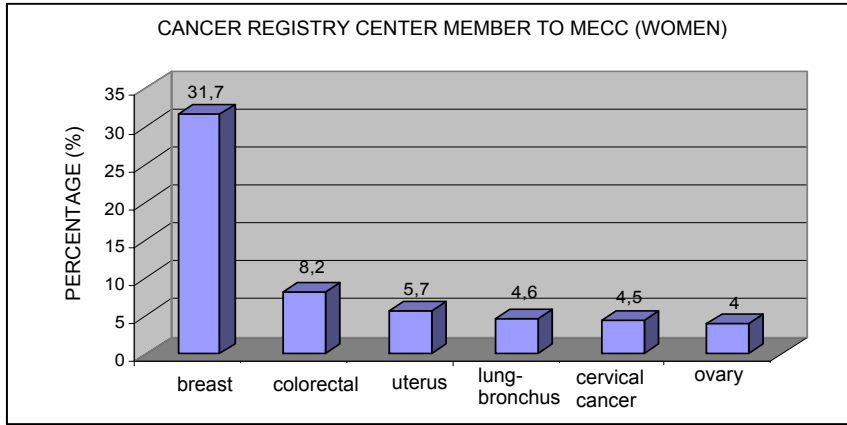
**Graph 1**

For men, the percentage is 27.4% for Lung-Bronchus cancers, 9.3% for Stomach cancer, 8.6% for prostate gland cancer, 6.9% for urinary bladder cancer, 6.2% for colon-rectum cancers. (Graph 2)



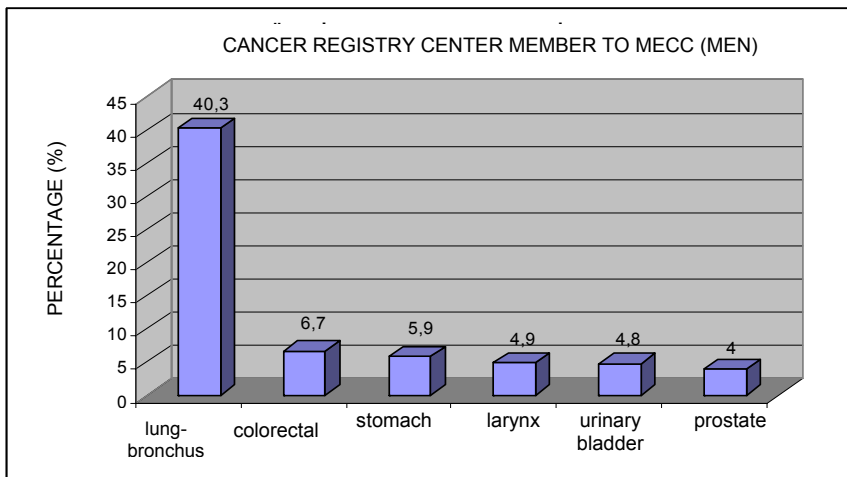
**Graph 2**

According to the Cancer Registry Center in İzmir, which is a member to the Middle East Cancer Consortium (MECC), in women, breast cancer is detected at 31.7%, colorectal cancers at 8.2%, uterus at 5.7%, bronchus-lung cancers at 4.6%, cervical cancers at 4.5% and ovary cancer at 4% (Graph 3)



**Graph 3**

In men, Lung-Bronchus cancers are detected at 40.3 %, Colorectal cancer at 6.7 %, Stomach cancer at 5.9 %, Larynx cancer at 4.9 %, Urinary Bladder cancer at 4.8 % and Prostate Gland at 4%. (Graphic 4)



**Graph 4**

In order for our Department to collect cancer registries properly and completely, active cancer registering are being carried out in Ankara, Antalya, Samsun, Erzurum, Trabzon, İzmir, Edirne and Eskişehir provinces.

**In conclusion**, when the collected data are compared with each other, the cancer cases in the Black Sea region do not show an increase and distribution different from the data in other regions.

### **Results of the Research on Household Cancer Risk, Patient Burden and Cancer Awareness**

**Participants of the Research:** Prof. Dr. Nazmi BİLİR (Public Health Department of the Faculty of Medicine, Hacettepe University), Prof. Dr. Gül ERGÖR (Public Health Department of the Faculty of Medicine, 9 Eylül University), Prof. Dr. Gamze ÇAN (Public Health Department of the Faculty of Medicine, Black Sea Technical University), Associate Prof. Dr. Banu ÇAKIR (Public Health Department of the Faculty of Medicine, Hacettepe University), Dr. Eser KAYA, Dr. İ. Altay ÇELİK, İnci Özçelik, Dr. Sultan ESER YALÇIN (İzmir Provincial Health Directorate), Dr. Okan KARAOĞLANOĞLU (Samsun Provincial Health Directorate), Nurse Neşe ERDURAN (Trabzon Provincial Health Directorate), Dr. İ. Mete OĞUZLAR (Isparta Provincial Health Directorate), Prof. Dr. Gönül BUYAN (Turkish Atomic Energy Authority), Dr. Hakan DİREN (Rize Provincial Cancer Control Division Coordinator) and the officials working in the Department of Cancer Control of the Ministry of Health of the Turkish Republic.

The research was conducted in the districts of Fındıklı, Pazar and Ardeşen of the province of Rize where the level of cesium (Cs) was above the average level of Turkey according to the radioactivity measurements of the Turkish Atomic Energy Authority (TAEK) as well as in Eskikadın and İsmailce in Edirne, and Eğirdir district of the province of Isparta where cesium (Cs) level is at Turkey's average level. The whole populations of these settlement areas were included in the study. One person from each household was interviewed and surveys were filled in.

Totally 19211 households, 10230 of which in Rize, 255 of which is in Edirne and 8726 of which is in Isparta were included in the study. Table 1 and 2)

<b>Table 1 : Distribution of the households by provinces and districts</b>							
<b>DISTRICTS</b>	<b>PROVINCES</b>						<b>TOTAL</b>
	<b>EDİRNE</b>		<b>ISPARTA</b>		<b>RİZE</b>		
	<b>number</b>	<b>percentage</b>	<b>number</b>	<b>percentage</b>	<b>number</b>	<b>percentage</b>	
<b>ARDEŞEN</b>					2880	28.15	2880
<b>FINDIKLI</b>					2898	28.33	2898
<b>PAZAR</b>					4452	43.52	4452
<b>ATABEY</b>			1114	12.77			1114
<b>EĞİRDİR</b>			6436	73.76			6436
<b>AKSU</b>			1176	13.48			1176
<b>MERKEZ</b>	255	100,00					255
<b>TOPLAM</b>	255	100,00	8726	100.00	10230	100.00	<b>19211</b>

Data collection study was realized by using two forms. FORM - A has helped in collecting data concerning socio-demographical information and presence of cancer in the family, information on causes of cancer and methods for protection from cancer. FORM - B has been filled in for the persons who are cancer or who died of cancer in the households with cancer. Demographical characteristics regarding each patient or person died of cancer have helped in collecting data concerning the type, diagnosis and treatment of cancer.

<b>Table 2 : Distribution of the surveys by risk areas</b>		
	<b>Number of surveys</b>	<b>Percentage</b>
<b>Control Area</b>	8800	<b>45.8</b>
<b>Risk Area</b>	10411	<b>54.2</b>
<b>Total</b>	19211	<b>100.0</b>

When the results are examined in terms of cancer frequency; 43164 persons have participated in the study in the provinces of Edirne-Rize and 217 alive and 582 dead persons were detected. The ratio of persons with cancer was found out as  $((217+582)/43164)*100 = \% 1.8511$ . In the province of Isparta, which was the control group, 30306 people took part in the study and 117 alive and 445 dead persons were detected. The ratio of the people with cancer was found out as  $((117+445)/30306)*100 = \% 1.8544$ . The cancer frequency in Edirne-Rize and the control group Isparta was found to be equal. (Table 3)

<b>Table 3 : Cancer Frequency in the risk areas</b>			
		<b>Total</b>	<b>Cancer Rate</b>
<b>CONTROL</b>	<b>Number Of Total Households</b>	30306	<b>1.8544</b>
	<b>Number Of Living Cancer Patients</b>	117	
	<b>Number Of Dead Cancer Patients</b>	445	
<b>RISK AREA</b>	<b>Number Of Total Households</b>	43164	<b>1.8511</b>
	<b>Number Of Living Cancer Patients</b>	217	
	<b>Number Of Dead Cancer Patients</b>	582	

Consequently, in this study, data has been collected from 19211 households. Totally 73470 persons were living in these houses. There are no differences between the provinces of Edirne-Rize and the control group Isparta in terms of cancer frequency. “Excessiveness” was not found in the cancer frequency in the provinces of Edirne-Rize.

Level of knowledge on cancer is higher in Edirne-Rize region. Level of knowledge on the symptoms of cancer, causes of cancer and diagnosis methods is low in all regions. The knowledge on cancer has been obtained through television, but it is mostly wished to be learnt from a doctor. Most of the patients who have lung and head-neck cancer are the people who are smoking.

**In conclusion:** A meaningful difference was not found between the regions exposed to radiation and the control regions in terms of coarse cancer rate and cancer frequency.

### **Results of the Research of Molecular Genetics of Thyroid Cancer**

**Participants of the Research:** Associate Prof. Dr. Cengiz YAKICIER, Işık G. YULUĞ, Özlem KONU, Bilkent University, Molecular Biology and Genetics Department, BilGen Genetics and Biotechnology Center, Dr. Y. Yavuz İSKENDER (Cancer Early Diagnosis and Screening Center (KETEM) in Trabzon), the officials working in the Department of Cancer Control of the Ministry of Health of the Turkish Republic.

#### **Preliminary Information;**

- It is known that those who are exposed to over-radiation are at a high risk of thyroid cancer.

- It is known that radiation causes chromosomal (DNA) mutation and that cancer develops depending on the mutation in certain genes.
- Accordingly, there may be a relation between the type and frequency of mutation in the thyroid cancers and the radiation etiology.
- A particular type of mutation that directly indicates the radiation etiology in cancer is not known. However, there are scientific publications that express a relation between radiation in thyroid cancers and B-raf and mitochondrial DNA mutation frequency.

In the light of these facts, it was thought to conduct a research to see if there is a radiation-dependent genetic mutation in the thyroid cancers in the Black Sea region.

As a method, it was planned to compare the DNA mutations in the sample thyroid cancer cases in the Black Sea region which were exposed to radiation and in the thyroid cancer cases which were assumed to be free from exposure to radiation.

In the pathological samples collected from the hospitals in Trabzon, Samsun, Edirne provinces of the Black Sea region which were exposed to radiation (213 samples) and in the pathological samples taken from the hospitals in the provinces of İzmir, Ankara and Antalya which were not exposed to radiation (belonging to the patients who were diagnosed with thyroid cancer (especially papillary thyroid cancer) since 1990), mutation screening by extracting genetic material from paraffin block and molecular genetic analysis was carried out.

**As a result of such screening:**

<b>Table 4: B-raf Analyses ( Totally 59 Tumors )</b>		
	<b>Black Sea Region</b>	<b>Control Group</b>
<b>B-raf Mutation</b>	<b>14 (% 38)</b>	<b>8 (% 36)</b>
<b>Normal B- raf</b>	<b>23 (% 62)</b>	<b>14 (% 64)</b>

- The former studies have shown that B-raf mutations are more frequent in the thyroid cancers that are not associated with radiation.
- A meaningful difference was not observed between the two groups in this study. (Table 4)

<b>Table 5 : Major Mitochondrial DNA Deletions (Totally 183 tumors)</b>		
	<b>Black Sea region</b>	<b>Control Group</b>
<b>Mitochondrial Deletions</b>	<b>42 (% 36)</b>	<b>26 (% 41)</b>
<b>Those that do not involve deletion</b>	<b>75 (% 64)</b>	<b>40 (% 59)</b>

- The former studies have shown that mitochondrial DNA deletions are more frequent in the thyroid cancers that are associated with radiation.

- A meaningful difference was not observed between the two groups in this study. (Table 5)

**In conclusion:** No finding of DNA mutations that indicate radiation etiology in the thyroid cancer cases in the regions exposed to radiation was observed.

### **Results of the Research on the Measurement of Radiation Load (Determination of Biological dose)**

**Participants of the Research:** Dr. Deniz DALCI and staff working in the Çekmece Nuclear Research and Training Center, Turkish Atomic Energy Authority (TAEK), Dr. Y. Yavuz İSKENDER (Cancer Early Diagnosis and Screening Center (KETEM) in Trabzon), staff working in the Faculty of Medicine of the Black Sea Technical University and Trabzon Numune Hospital, staff working in the Department of Cancer Control of the Ministry of Health of the Turkish Republic.

Contribution in answering the following questions was aimed in this study:

- Are there any chromosome damages occurring in people in the region because they have been exposed to radiation for the last 2-3 years?

- Are there any damages caused by radiation exposure in the past?

- Is there any difference between the chromosome damages in the regional people and the chromosome damages of those living in the control areas that are free from the effects of Chernobyl?

- Is it possible to detect in the cancer patients the chromosome damages that are specific to the family and / or to the region?

- Is it possible to reveal the presence of physical and chemical factors (toxic chemical substances etc.), other than radiation, that are specific to the region and that may cause chromosome breakages?

In this study, it was planned to conduct biological dose study through three separate cytogenesis methods (dysenteric chromosome aberration, micronucleus and FISH) on the untreated cancer patients at or over the age of 20 who presented to the Faculty of Medicine of the Black Sea Technical University and the Trabzon Numune Hospital and three relatives of each.

#### **Evaluation**

- The study was launched with the first blood samples taken from the Trabzon Numune Hospital on September 29, 2005.

- Up to date, culture tests have been conducted on 58 blood samples of the people from the Black Sea region for chromosome aberration (CA) analysis and micronucleus (MN) analysis.

- In 9 persons out of 23 for whom chromosome analyses was possible dysenteric aberration was not found (5 persons' dose were below 100mGy).

- Almost all of these patients have stated that they have been exposed to ionizing radiation for diagnostic purposes.

- In the blood samples of 8 persons to whom micronucleus analysis was applied, high-level MN frequency was observed.

- These results indicate that the environmental factors, i.e. chemical agents are more influential than the ionizing radiations.

- In recent years an increase in the frequency of MN in the society has been observed.

The reason for this is thought to be the ever increasing consumption of fast food, smoking cigarette, medical applications, use of medicine, environmental pollution and the use of petroleum and its derivatives.

- Isparta was chosen as the control area of the study and CA and MN cultures were conducted on 31 blood samples that have been sent as of June 15, 2006 and MN slides of 5 persons were assessed.

**In conclusion:** In the light of the data obtained, except for those which have been applied for medical purposes within the last 2-3 years, radiation exposure was not observed to be influential in chromosome damages.

## References

1. International Atomic Energy Agency
2. Sources of the Turkish Atomic Energy Authority