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Preface

The publication process of the 'Inspiring Technologies and Innovations (INOTECH)' journal is continuing with the decision numbered 261 taken at the session of the Senate of Kastamonu University dated 2.12.2021 and numbered 26, and with the coordination of Kastamonu University Technology Transfer Office.

Our journal named 'Inspiring Technologies and Innovations (INOTECH) , which is a pioneer because it prioritizes R&D and innovation issues in multidisciplinary fields, is a peer-reviewed, open access, free publication policy and periodical research journal by Kastamonu University twice a year.

Aiming to develop in the way of presenting qualified works to national and international readers with the principle of scientific publishing, this first issue of our journal includes 5 original research and 1 review research articles from different disciplines and research fields.

We would like to thank all the academicians who contributed by sending their works, and all the referees who contributed in the evaluation process of these works;

We hope that the interest and support for our journal from the national and international community will increase.

Regards.

Prof. Dr. Kasım YENİGÜN

Chief Editor

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Research Article

Evaluation the Knowledge and Radiation Protection of Radiation Workers at Ibensina Hospital

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ABSTRACT: To evaluate the knowledge and awareness of radiation worker's towards radiation protection. Each day people are effecting by Ionizing radiations. The ionizing radiation is produced several types of hazards. Thus, technicians are working at hospitals should be have good knowledge about radiation protection. In this study, the questionnaire based cross-sectional study performed at Ibensina hospitals-Sirte city, Libya between July -30August 2021 years out of 38 radiation workers. All data collected from some questionnaire and analyzed by microsoft Excel softwere surveyed. The results shows that the most age of the radiation workers are between 31 – 40 years bachelor holders 23 (76.7%), 6 male and 15 female. All radiation workers (100%) have studyed primary examination while start work. However, periodical examination did not since started work (100%).

KEYWORDS: Radiation Protection, Radiation Workers, Ionizing Radiation and Film Badges

1. INTRODUCTION

Medical imaging serves as first source of investigation and give appear to us proper diagnosis [1]. Ionizing radiation acts on living systems through indirect and direct effects. Indirect effects is interacting radiation with organic molecules and water then produced unstable free radical, whereas direct effects the biological molecules are absorbed high energy of ionizing radiation [2]. Important methods used in medicine are ionizing radiations. Which is energy in form of as alpha and beta particles or gamma and x-rays waves. The ionizing radiations have side effects and cause several kinds of cancers. That why protection applications against ionizing radiations should be applied [3]. Ionizing radiation has been found from the starting of creation, [4]. Radiotherapy, x-ray diagnostic and nuclear medicine all these examples of ionizing radiations. Radiation workers will be at risk due radiations exposures. The radiology technicians needs safety methods to prevent dangers of ionizing radiations and continues radiation measurement [4-5-6]. At the present days, medical imaging is very important for treatment and diagnosis [7-8]. In Kenya 2011 several studies have shown in difference countries to measure annual equivalent doses of radiation workers [9]. In Saudi Arabia 2017 the level of annual exposure ranged from 0.32 - 6.98 mSv [10]. For radiotherapy workers average annual effective dose found 0.28 mSv. Decreasing reasons might be due to application of international regulations for the radiation protection. The aim of this study is to evaluate the knowledge and awareness of radiation worker's towards radiation protection.

2. MATERIALS AND METHODS

In this study, we explored 30 samples selected randomly out of 38 radiation technicians working at Ibensina hospital Through differnt several multi choice questionnaires data was collected and by using Excial softwere surveyed data was analyzed. The study survey of radiation exposure measurements of radiation technicians in Ibensina hospital never done. Not all radiation technicians did periodic medical examinations and no radiation warning sign in work place. Most of radiation workers have poor knowledge as result about ionizing radiation. Increasing cancer mortality relative rate as result by increasing ionizing radiation exposure at low dose [13- 14]. Leukaemia hazard Estimates might be affect medical technicians exposed to X and gamma rays law doses, it useful used monitoring dosimeter [15]. Clinical indication had advised people should know to reduce radiation dose of CT scans uses in lowest possible radiation dose and limited cases of diagnostic image [16].

3. RESULTS and DISCUSSION

Medical radiology workers exposed to radiations should be under rules of general principles of occupational medicine as recommended by International commission on Radiation Protection (ICRP). [11]. The question are based cross-sectional study performed at Ibensina hospital-Sirte city, Libya between July and August 30 out of 38 radiation workers. Data collected from some question and analyzed by Excell simulation. The rules helpful and ensures initial and continues compatibility between radiology workers health and radiation work conditions. Thus, it gave perfect information's in the case of occupational disease. Health conditions and work nature require medical surveillance programming for radiology workers [12]. The study survey of radiation exposure measurements of radiation technicians in Ibensina hospital never done. Not all radiation technicians did periodic medical examinations and no radiation warning sign in work place. X -rays machine calibration and Radiation survey never done. Most of radiation workers have poor knowledge as result about ionizing radiation. Increasing cancer mortality relative rate as result by increasing ionizing radiation exposure at low dose [13-14]. Leukaemia hazard Estimates might be affect medical technicians exposed to X and gamma rays law doses, it useful used monitoring dosimeter [15]. Clinical indication had advised people should know to reduce radiation dose of CT scans uses in the lowest possible radiation dose and limited cases of diagnostic image [16]. Thirty radiology technician completed primitive medical examinations since starting working. However, all radiation workers have done periodic medical test, as well as, radiology workers did not have personal monitoring devices to measuring the level of radiation exposure. As shown in table -2 periodic radiation and calibration have not done since started work. Figure-1 show that 30 radiation technicians (%33,3 male +%66.7 female) working at Ibensina hospital. At table-1 is given about radiation workers gender and working years in Ibensina Hospital at Sirte –Libya.

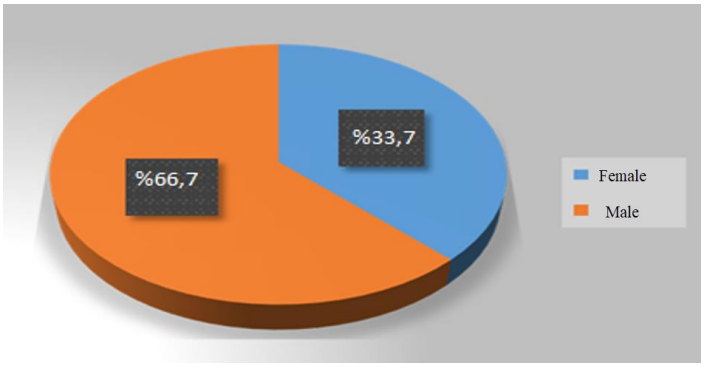

Figure 1. Radiation technician male and felame distributions

Table 1. Male and Female Working Years

Gender	WORKING YEARS					
	1-10 years		11-20 years		Total	
	No	%	No	%	No	%
Male	8	42.1	2	18.1	10	33.3
Female	11	57.9	9	81.9	20	66.7
Total	19	100	11	100	30	100

Table 2. Periodic, Primitive and Radiation Protection Responsible

PRIMITIVE MEDICAL EXAMINATION	No	%
Yes	30	100
No	0.0	0.0
Total	30	100
Periodic Medical examination	-	Never done
Radiation Protection Responsible	-	NO
Supply Radiation Dosimeter	-	NO
Done x-ray machine calibration	-	Never done
Done periodic radiation survey	-	Never done

At the table-2 is given about supply radiation dosimeter and x-ray machine calibration and periodic radiation survey and primitive medical examination. At table-3 is given about radiation workers gender and working years in hospital.

Table 3. Qualifications of Radiation Workers

QUALIFICATIONS							
Gender	**Age**	**Institute**		**University**		**Total**	
		No	%	No	%	No	%
Male	20-30	1	100.0	2	22.2	33.3	3
	31 -40	0	0.00	6	66.7	6	66.7
	41- 50	0	0.00	1	11.1	0	0.0
	Total	1	100.0	9	100.0	100.0	9
	20- 30	0	0.00	3	15	15	3
	31- 40	0	0.00	17	85	85	17
	41- 50	0	0.00	0	0	0.0	0.0
Female	Total	0	0.00	20	100	100.0	20
	31- 40	0.0	0.00	17	85	85	17
	41- 50	0.00	0.00	0	0	0	0.0
	Total	0	0.00	0	100	100.0	20

4. CONCLUSION

In recent years, the opinion that the monthly and annual doses of the personnel working in the radiation and nuclear medicine departments of the hospitals are important for both their own health and their families has developed. I did not come across.The results study revealed knowledge and awareness regarding radiation protection. Healthy program for radiology workers should wear personal monitoring device and radiation department is required healthy physics candidate, safety professional and radiation technicians themselves. To follow international commission on radiation protection (ICRP) the radiation technicians should have courses about radiation risk and radiation protection. It is important for technicians during work to wear personal film badges as mentioned in international commission of radiation protection. However, all radiation workers dosent supplied with personal film badges and most of technicians each week working between 39 and 42 hours. Colibration X -rays machine and Radiation survey have not been done. Most of radiation workers have poor knowledge about radiation protection. Healthy program for radiation technicians is important. Thus, should be provide radiation workers by personal film badges and training radiation protection courses.

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Inspiring Technologies and Innovations

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Research Article

Strategies of Growth for Entrepreneurial Ecosystem in Technological Parks: Example of National Technopark

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ABSTRACT: It is clear that important developments will be achieved in growth strategies with information, education, governance and wide-ranging reforms in order to create strong foundations. In the entrepreneurship ecosystem; Technoparks provide a business environment that supports entrepreneurship and contribute to local and global change and development. With the many advantages and supports provided to businesses through technoparks, realization of social goals, competition, quality and added value to the country's economy in many aspects are provided. With this aspect, technoparks play an important role in the growth strategies of the businesses they house. The aim of this study; To determine the growth strategies of all companies operating in the technopark and to measure their differences according to demographic characteristics. For this purpose, data were collected from 48 years ago. The data of the research; It was measured by factor analysis, t-test and analysis of variance (ANOVA) and correlation analysis using SPSS. As a result of the research, it was not determined that there were significant differences between the growth strategies of the participants and their demographic characteristics.

KEYWORDS: Entrepreneurship, Enlightened Ecosystem, Technoparks, Growth Strategies

1. INTRODUCTION

When human history is examined, it is possible to find the first examples of entrepreneurship from hunter-gatherer times to mining age. This traces entrepreneurship back as far as human history. As humans interact with each other, a small amount of commercial mobility has emerged. This small-scale commercial mobility eventually triggered manufacturing, resulting in the emergence of large commercial routes and transformed the outer-closed lifestyle of various groups into a life-form that was headed toward urbanization. Entrepreneurship around the world has been one of the major issues in recent years, both in terms of states and in terms of private sector and industry, as entrepreneurship is one of the key factors driving economic growth. There are strong links between entrepreneurship and economic growth, technological development, innovation, competitiveness, employment, and there are increasingly studies being done to identify and understand the importance of these strong links. Globalization has recognized the importance of integration and strong competition, and the need for new, high-tech products has increased. Development and sustainability in the economic sense has become imperative, to solve high unemployment, to provide economic peace and prosperity. All these processes have made entrepreneurial activities increasingly important in new and strategic development plans.

The process of entrepreneurship brings with it innovation. This is providing economic growth and accelerating development. In this context, many empirical studies have been done concerning the economic growth and employment growth of national or international entrepreneurship and innovation. From these studies, entrepreneurship training, entrepreneurship acceleration programs, and economic activities were undertaken. To ensure sustainability for these activities, a variety of entrepreneurial centers and acceleration programs are being organized by various organizations and organizations to provide entrepreneurial spirit today, provide a useful environment for the needs, and provide support at the point of supply. These centers provide support for initiatives that are in the intellectual phase or have just been established for office and office appliances, workspace, prototyping support, business management and organization, industry and market analysis, competition analysis, market research, law and financing provision. Such centers also support entrepreneurs in the areas of consulting, training, certification, accreditation, information-technology transfer and sharing through the mentors, which are included in their respective expert and expert advisory status. Usually these centers are located inside technoparks, universities and large-scale technology

companies. Among these sites, one of the most important is the technology park, which plays a major role in business growth strategies.

The study primarily focused on entrepreneurship, the entrepreneurial ecosystem, business growth strategies, and conceptual definitions of technoparks, and issues related to growth strategies of businesses in technoparks. This study collected data from a survey of 48 entrepreneurial firms operating in the UluTEK Technological Park of the University of Bursa. The study's data was measured using SPSS with factor analysis, t-test and variance analysis (ANOVA) analysis, and correlation analysis. Differences in technology park entrepreneurs' growth strategies and demographic characteristics have been measured.

3. CONCEPTUAL FRAME

3.1. Ecosystem of Entrepreneurship and Entrepreneurship

Business science is gradually improving. New situations, approaches, and work, along with business concepts, give new meanings and dimensions. In this sense, ongoing development has shown a number of definitions of entrepreneurship, a necessity for the country's economies. Entrepreneurship is a concept derived from French as entrependre. He was first introduced into the literature by the economist J. B. Say. Entrepreneurship is defined as the process by which an individual or group is given the power and opportunity to fulfill their needs, by uniquely innovating to create value and growth, regardless of what resources they have (Minimizing, 2009: 22). Entrepreneurship is to take psychological and social risks economically through an effort to establish value (Demirel, 2003: 9). Again entrepreneurship is the creation and development of any business, regardless of size (Erdogan, 2012: 27). Entrepreneurship is a series of activities for the creation of organizations (Gartner, 1988: 47). Entrepreneurship is the building of new businesses and the enabling of commercial potential and applicability into a product, service, or manufacturing process innovation (Chetinavear, 2002: 10). The French scientist Richard Cantillon described the concept of entrepreneurship as "the one who takes a risk apart from the equity owner." (Scotch, Diligent, Orange, 2019: 2). It is possible to define entrepreneurship by the following definitions:

Activities associated with being entrepreneurial or entrepreneurial represent a set of skills that a person needs to successfully launch and run a small business.
Being an entrepreneur is about having an administrative ability and also about accepting the risk of starting and running a business for innovation and profit.
It's all the productive resources of a for-profit decision maker that decides what economic activity to participate in and how to undertake them.
It refers to people who are willing to risk their time, money, to run, set up, manage a business and shows a willingness to take on the risks involved.
It is the process of creating a business that can uniquely distribute resources and people to develop a new organization and enter new or established markets.
It relates to management skills or the personal initiative used to combine resources in productive ways, and the quality of being entrepreneurial and pro-active is the practice of starting or taking on new jobs.
Entrepreneurship is a process in which individuals and groups pursue opportunities, exploit resources and embark on change to create value through proactive living.

Entrepreneurship and innovation/innovation have become one of the most prominent political topics in Turkey in recent years (Candless, Cunning, and Yavan, 2018: 3). Entrepreneurship is considered a critical factor for economic development (Eliasson and Henderson, 2004: 3). To increase entrepreneurial activity, one has to discover the skills of individuals or groups. There are many factors influencing entrepreneurship, such as education, family, cultural values, resource use, gender, age, economic policies, development programs, or laws.

The entrepreneurial ecosystem refers to all of the entrepreneurial processes that are connected, such as existing entrepreneurial actors, firms, venture capitalists, angel investors, banks, entrepreneurs, enterprises; universities, public sector institutions, financial institutions; institutions such as business birthrate, the number of fast-growing firms that officially and informally merge to connect, mediate and manage performance in the local entrepreneurship environment, levels of blockbuster entrepreneurship, the number of serial entrepreneurial levels, the degree of selling mentality within firms, and levels of entrepreneurial ambition (Mason and Brown, 2014:5). In another definition, the entrepreneurial ecosystem refers to a structure that promotes and finances innovative initiatives through the combination of social, political, cultural, and economic resources

in a region, encouraging establishment of high-risk enterprises or taking risks (Spigel, 2017: 50). The entrepreneurial ecosystem, often offered as a list or scheme, contains a number of players or stakeholders along with the required components and often emphasizes through networks the combination or interaction of factors that produce common cultural values that underpin entrepreneurial activity (Malecki, 2017: 5).

The concept was first used by Moore (1993) as a business ecosystem, meaning business ecosystem, unlike biology or ecology (Moore, 1993), and argued that businesses should not be judged solely by a single industry and should be seen as part of the structure covering different sectors in the business ecosystem (1993: 76). The entrepreneurial ecosystem has a close relationship with economic development and prosperity (Alper, 2020: 7). It is necessary to establish a self-contained system in the entrepreneurial ecosystem in order to ensure economic development and prosperity and to integrate all the components in a systematic manner. One of the most important features of the entrepreneurial enterprise is that there is a culture in the entrepreneurial ecosystem that promotes risk-taking. It encourages risk-taking and offers innovative initiatives and steps towards social and economic goals. In the entrepreneurial ecosystem, there is not just the temptation for risk, but also investors, mentors, policies that promote entrepreneurship, regional components or economic components that are involved. Entrepreneurship is underpinned by regional and national economic development, which needs entrepreneurial support to achieve these goals. There are many factors for entrepreneurs to be successful. One of the most important criteria for success depends on the size of the entrepreneurial ecosystem in which they depend, the volume of multifaceted material, and the richness of the elements. At the same time, entrepreneurs need to interact tightly with organizations, organizations, organizations, individuals, and centers in the ecosystem such as individuals (Entrepreneurs, venture programs coordinated by research universities and universities, business or entrepreneurship programs organized by research universities, government-funded programs, commerce rooms, and accelerator programs by technoparks affiliated with universities, incubation centers and private organizations. The entrepreneurial ecosystem is characterized as a social and economic environment, affecting entrepreneurship in a regional or national sense. The entrepreneurial ecosystem is a set of actors and factors that act in unison and that support productive entrepreneurship. There are elements that make up the ecosystem of entrepreneurship, and it turns out that these elements have a supportive, restorative, accelerating, encouraging effect for entrepreneurial activity in every region and country. These elements, classified in several different categories, are shown in Table 1 (WEF, 2013: 7, Mason, and Brown, 2014: 24, www.teknogirisimokulu.com/).

Table 1. Entrepreneurial elements and sub-components of ecosystem

Access to entrepreneurial financing and financing	Nearby (friend, family) Angel Investors, Private Equity, Venture Capital, Credit and capital markets
Government policies, trade, and legal infrastructure	Regulations in the social security sphere, the justice and tax system, incentives, barriers to bureaucracy, executive and bankruptcy, and legal regulations for product markets, investment framework and shape
Public entrepreneurship programs, entrepreneurial education and training	Universities or other public institutions-led programs, Program time, intensity, purpose, outputs, education, training, experience, entrepreneurship infrastructure, consulting services, professional support, mentors, incubation centers, and accelerators, staff competency (in-service training, hybrid certification programs)
Accessible Markets	Large and medium enterprises in the domestic and international market, government firms, quality markets, public tenders
Research development, technology and information transfer	University and industry collaboration, intercompany interaction, information and technology sharing, and support
Physical infrastructure	Basic infrastructure systems, Internet, environmental regulations
Cultural and social norms	Labor mobility, local or national culture, perceptions of risk and entrepreneurship, willingness to own a business, social capital and trust, Success stories, positive entrepreneurship chart, risk and failure-defined tolerance level, success factors

Source: (WEF, 2013: 7, Mason and Brown, 2014: 24, www.teknogirisimokulu.com/)

3.2. Technoparks

There is no uniformly accepted definition for technoparks. There are more than one term used similarly to research park, science park, technology park, business park, innovation center, technopolis (Löfsten and Lindelöf, 2002: 861). Technoparks are business development ecosystems and they share environments (www.tgbd.org.tr/1986) in collaboration between universities, research institutions, and industrial organizations for the purposes of research and development, innovation, technology and information transfer, interaction, economic-social integration, and organized movement. As of 1986, the concept of technopark came to

prominence and began to take part in development plans. As a result of the increased interest and importance in technology and science, various steps were taken as part of the technopark in Turkey in the 90s (Capkin, 2019: 49). The "Technology Development Zones Act" came into force on 6 July 2001 with the publication of Law 4961 in the Official Gazette. The first technopark installation in our country was performed by ODI (Blend and Öönen, 1999). In our country, under the Technology Development Zones Act 4691, the state-of-the-art organizations and operations were regulated, and technoparks with great significance in the entrepreneurial ecosystem were established with the aim of developing value-added technology products and increasing exports, paving the way for technological development and entrepreneurship. The activities of entrepreneurs and companies doing business in these areas are supported in commercialization and in many areas. There are also many tax breaks, exceptions, and export incentives. These support are (Act 4691, www.turmob.org.tr):

Tax support on wages: Exempt any tax from any costs associated with this duty of R&D staff.
Exception of customs duty and fees: R&D, goods imported for use in research related to innovation and design are exempt from customs duty and its regulated papers, the transactions are stamped tax and fees.
Exceptions in income and corporate taxes: Exemption of income and corporate tax on profits from software and R&D activities. (until 12/31/2023).
SGK premium exemption: For companies, R&D, design or support staff, SGK does not pay 50% of the employer premium share.
VAT exception: Delivery and servicing of systems management, data management operations, business applications, internet, mobile and military command, and control application software are assessed as a VAT exception.

There are many benefits that technoparks bring to entrepreneurs, to the region and to the university. Locally, it promotes the emergence of regional dynamics and the strengthening of communication among local actors, thus increasing productivity and helping to promote strong competition. Reducing unemployment, increasing employment opportunities, and contributing to nationwide, even global, gains beginning locally (Polat, 2003). From the point of view of entrepreneurs, it teaches project-based work and reinforces that aspect of entrepreneurs. The university and industry employ cooperation to ensure movement and benefit from government subsidies. It increases training and skilled labor capacity, and paves the way for interaction with other entrepreneurs or entrepreneurs, and provides an environment for that. By building joint projects, it speeds up the development of firms or entrepreneurs and facilitates quality product and market discovery (Bella Vista and Sanz, 2009). From the university's point of view, the theoretical focus allows for many studies to be carried out on the ground. It provides an outward shift in information and technology, particularly in the context of an introvert structure, and contributes to new strategic studies by acting in partnership with the private sector or industry. Universities offer entrepreneurs a broad range of benefits in knowledge, accumulation, IT, management and theoretical aspects of the entrepreneurial ecosystem through technoparks, and respond to the needs of entrepreneurs in all senses, with laboratories, equipment, equipment, and so on. As a result, an assessment is made, the establishment of technoparks and the development strategies of the technoparks to revitalize the country's industry by providing joint studies on this axis to meet the need for domestic technology, to conduct effective education activities in universities, to address the existing problems in the industry, to utilize the accumulation of academic knowledge within the university, and to promote the sharing of this information in needed areas, to promote comparable potential product production, to improve employment and to encourage entrepreneurship in innovative environments, and to take an active part in the growth strategies of the businesses involved in technoparks. In this context, Ulutek Teknopark was founded under the leadership of Uludag University. Here is a short dog tags from ULUTEK that were set up to perform activities for the purposes of the entrepreneurial ecosystem:
"ULUTEK Technological Development Zone was established by the Council of Ministers Resolution 2005/9310, published on 08.09.2005 and Official Gazette 25930, and is located in the Bursa Uludag University Gorbule Campus 471.230 m2 area as Turkey's 17th Technology Development Zone," (www.ulutek.com.tr).

3.3. Business Growth Strategy

There are two types of growth in businesses: organic and inorganic. Organic growth is a business's ability to leverage its own power and resources to grow. In organic growth, there's a focus on new markets and new products, it's hard to grow. The external obstacles to organic growth are caused by saturated markets, increased competition, increased supplier and customer strength, and insufficient funding. Due to these barriers, there is a shift in growth strategy from organic growth to inorganic growth (IronGrass and Sweet, 2017: 320). Growth strategies are grouped together as integration strategies, diversification strategies, external growth strategies, and explained as follows (Tumors, etc.). 2018: 94-97, www.timder.org.tr):

First, integrative strategies are defined by the business in the event that the product and market remain the same and are classified as horizontal-vertical integration strategies. Businesses that implement a horizontal integration strategy are exemplified by businesses that implement this horizontal integration strategy to expand operational area to maintain market dominance, and businesses are looking for an increase in the number of service production points to achieve this goal. The strategy to follow is market penetration, product differentiation, and market differentiation. Market penetration means greater market penetration and there is no change in this strategy because it is the ultimate goal of increasing sales. The product differentiation strategy refers to differentiation of the product in terms of quality, design, packaging by the business and is intended to increase market dominance. The market differentiation strategy is to find new uses for existing products and to identify and market those who are not using the product.

Strategies for growth of resources or distribution channels are vertical integrator strategies. Backward vertical growth is called growth in resources, while forward-looking vertical growth is called growth in distribution channels. One example is a forward-looking vertical growth where a company that produces an aircraft engine also starts production. The vertical growth of retroactive growth may be exemplified by the investment of an aircraft manufacturer in aircraft engine production. Secondly, diversification strategies refer to market with a new product or strategies for opening up to new markets with existing products and involve one-way and multiple-way diversification in the market. One-way diversification includes the focus on a product and the search for new markets. There is also a strategy to introduce new products that come with the use of new technologies in the current market. The range of diversification strategies refers entirely to the new market and new product insights. Finally, another growth method is realized through external growth strategies. The business's choice to grow using other business-owned resources is seen as an example of a strategy for external growth, and again mergers, acquisitions, joint ventures, and methods of external growth can be considered.

3.4. Technology Parks & Business Growth Relationship

Growth is key to business objectives. Businesses are open systems that interact continuously with their environment and are strongly influenced by their environment. So there's a live organism analogy that you can do for business. It is influenced by all the changes that occur economically, socially, politically and technologically. Businesses need to stay successful and continue the process with a modern management insight to maintain and grow their presence, including production, competition, quality, distribution, customer-driven service and all aspects of the business. Together with a balanced growth process, they have continued to do so in strategic ways and contributed to the development process. In this regard, they may require development and support in order to meet the various needs of the social and economic sphere, present a new product or service to existing markets that will result in success, develop processes that are constructed through the necessity of developing an application, method or business model, and the implications of these processes, through an innovative way of ensuring sustainability in a constantly-varying competitive environment, and in the context of the struggle, the need to continuously alter the products, methods of production, and services of entrepreneurs in this sense. One of the environments where that need is taken care of is technoparks. With innovative approaches to technoparks, companies are given training, mentoring, information support, laboratory support, which contributes to their growth. Technoparks also lead the way for application-oriented research and new ideas. Technoparks are a key tool in the growth of companies, including R&D projects, university industrial cooperation, strategic R&D efforts and the implementation of these studies, commercial product practices, export growth and competitive advantage, support of all fields, and growth of industrial companies, and are again pioneering in the growth of businesses, such as IT, marketing and advertising companies, factories, that have been at the point of co-operation.

4. METHOD

4.1. Model and Hypotheses of Research

The research model and hypotheses undertaken for the purposes of the study are as follows:

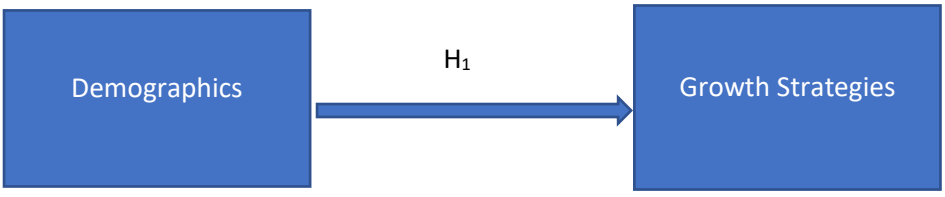

Figure 1. Model of Research

The model created to test hypotheses established in the context of this theoretical framework is considered to be the "Demographic Properties" argument. "Growth Strategies" is treated as an argument. The conceptual framework and the overall structure of research agreed to test the following hypotheses.

H1: Participants' growth strategies differ significantly from demographic factors.
H1a: Participants' growth strategies differ significantly from age.
H1b: Participants' growth strategies differ significantly from gender to gender.
H1c: Participants' growth strategies differ significantly from their level of education.
H1d: Participants' growth strategies differ significantly from work experience.
H1e: Participants' growth strategies vary significantly from how they operate in the technopark.
H2: According to demographic features, there is a relationship between participants' growth strategies.

4.2. Universe and Sampling

The universe of research is 78 entrepreneurial firms based at ULUTEK Teknopark, under the umbrella of the University of Uludag. The research consists of 48 voluntary participants selected by random sampling method.

4.3. Data Collection Tools

On a two-part scale, prepared for research, the first part relates to the demographic features of participants. The second part is aimed at developing growth strategies.
Scale of Growth Strategies: A "Scale of Growth Strategies" developed by Sekman (2017) is used to measure participants' growth strategies. The scale of growth strategies is two-dimensional and consists of 12 items, and there are no inversely coded materials. The 1st, 2nd, 3rd, 4th, 5th, and 7th items on the scale represent the "Strategies for Manufacturing Marketing and Innovation in the Market" dimension. Articles 6, 8, 9, 10, 11, and 12 represent the size "Strategies for New and Major Markets". Scale is included in the questionnaire form as a five-limerite type. Scale items include responses such as "1= Not important, 2=Not important, 3=Not important, 4=Important, and 5=Very important".

4.4. Analysis Method

The research used an analysis of the data obtained from participants' responses to the SPSS statistical packet program developed for social sciences. The research analyzed the correlation between growth strategies and demographic characteristics of entrepreneurs in the UluTEK University of Bursa and used parametric tests such as Anova and T-test to determine the difference between variables.

5. FINDINGS

5.1. Demographic Data Findings

33 of the participants were male and 15 female participants. Given the age of participants, it is understood that there is a greater density in the range of 25-30 and 31-35. Participants' level of education is understood to be at a higher level of pre-bachelor's and bachelor's degrees, with business experience concentrated between 1-5 and 6-10 years. As a result of the technology park's operating time, the startup firms are likely to operate within 0-6 months and 6 months to 1 year in the technopark. Detailed information about the demographic data is shown in Table 2:

Table 2. Demographic Data Findings

		N	%
Gender	Female	AD 15	AD 31
	Male	AD 33	AD 69
Age	18-24	AD 3	6.3
	25-30	AD 17	35.4
	31-35	AD 19	39.6
	36-40	AD 5	10.4
	41 and up	AD 4	8.3
Level of Education	Elementary school	0	0
	High school	AD 5	10.4
	Pre-licensing	AD 15	31.3
	License	AD 22	45.8

	Graduate	AD 6	12.5
	1-5 years	AD 19	39.6
	6-10 years	AD 17	35.4
Work Experience	11-20 years	AD 9	18.8
	21-30 years	AD 3	6.3
	31-Over	0	0
	0-6 months	AD 10	20.8
	6 months to 1 year	AD 12	AD 25
Activity Time in Technopark	1 year to 2 years	AD 15	31.3
	2 years to 5 years	AD 8	16.7
	5 years and up	AD 3	6.3

5.2. Reliability and Validity Analysis

Accountability and validation analysis results for the scale of growth strategies are as follows in Table 3:

Table 3. Results of Reliability and Validity Analysis of Scale of Growth Strategies

Sampling Rate (KMO)		16.81
Bartlett's Test	Ki-Square Value	537.21
	df	AD 6
	p	120.00
Variables for Growth Strategies	Factors	
	AD 1	AD 2
Becoming the first company to promote new brands and products in the market	12.942	
Your go-to-market product/service innovation and frequency	12.932	
Our business has high quality superproducts in the market	176.70	
Taking over a high-income market segment	728.78	
To capture technology leadership through R&D activities and to capture the promise of markets	698.68	
Acquire a larger market segment than our competitors	689.69	
Enhancing our ability to develop product design technology and manufacturing processes		12.382
The activity of our sales and distribution channels		6.899
Reduce production costs to maintain our competitiveness		6.862
Continued improvement and improvement of our existing product/services on the market		3.722
Evaluate new business and market opportunities identified		691.61
Responding to different customer needs in different markets		12.564
Described Variance	61.741	11.218
Total Variance	72.95	
Alpha Value for Factors	193.90	809
Alpha Value for Entire Scale	3.937	

In the study, the scale of Growth Strategies was used. In a reliability analysis of scale, "Croncbach Alpha Coefficient method" is done, and in validity analysis, "Descriptive Factor Analysis" is done. With the Keiser-Meyer-Olkin (KMO) and Barlette Tests of Globalism, data has been found to be compliant with factor analysis. Keiser-Meyer-Olkin (KMO) demonstrates the suitability of the data for this analysis if the test rate is 0.60 and above (Nakip 2003:409; Tabachnick and Mark). 2001: 589). The scale is seen to be meaningful in terms of the CDOs of 811 and the Barlette Global Test (Sig=0,000). A descriptive factor analysis for the scale of growth strategies showed that the scale explained a 2-dimensional structure and 72,959 of the total variance. Factor charge value is at least 30%, which is generally accepted in social sciences, and values above 50 are considered sufficient. (No and ark. 1998: 385).

5.3. One-Way Variance Analysis (ANOVA) Results

The hypotheses that were created to determine if their participation's growth strategies varied from demographic factors were tested using one-way variance analysis (ANOVA) and the results of the analysis were evaluated below. A one-way analysis of variance (ANOVA) has been conducted to determine whether growth strategies differ by age, but prior to this analysis, homogeneity of variances, the fundamental assumption of the analysis, is required. The "Levene Test" was performed to determine whether the variances were homogeneously distributed, and the results are as follows in Table 4:

Table 4. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Growth Strategy	6.818	AD 4	AD 43	120.00

Seen in Table 4, p is valued at 0.000. P values less than 0.05 indicate that variances are not homogeneously distributed. The Welch and Brown-Forsythe tests are used alternately when the homogeneity of variants, the main assumption of one-way variance analysis (ANOVA), is not provided. In this context, the data was first tested by Welch and Brown-Forsythe.

Table 5. Average Growth Strategies

	Sum of Squares	df	Mean Square (song)	F.	Sig.
Between Groups	2.513	AD 4	628.68	1.671	112.174
Within Groups	16.170	AD 43	376.36		
Total	18.683	AD 47			

As part of the study, the table 5 shows that due to the fact that the one-way variance analysis F-value is 1,671 and p is 0,174 (p:0,174>0,05) participants' growth strategies do not differ significantly from the age factor. The H1a hypothesis is not supported in this context of data.

Table 6. Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Growth Strategy	Based on Mean	4.538	AD 3	AD 4	12.07

A one-way variance analysis (ANOVA) has been done to determine if growth strategies differ from the educational situation, but prior to this analysis the homogeneity of variants described as the fundamental assumption of the analysis is required. In this context, a Levene test was performed to determine whether the variants were distributed homogeneously. Table 6 shows the results of the Levene test.

Table 7. Anova Testing for Growth Strategies Training Status

	Sum of Squares	df	Mean Square (song)	F.	Sig.
Between Groups	2.308	AD 3	769.79	2.067	118.18
Within Groups	16.375	AD 4	372.32		
Total	18.683	AD 47			

As part of the study, one-way variance analysis shows that due to the F-value of 2,067 and p of 0.118 (p:0,118>0.05) participants' growth strategies do not differ significantly from their education state. The H1c hypothesis is not supported in this context of data. The result of the Levene test in Table 8 is that p=0,789>0,005 can perform a one-way variance analysis.

Table 8. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Growth strategy	350.350	AD 3	AD 4	789.79

Table 9. Growth Strategies Business Experience: Anova Result

	Sum of Squares	df	Mean Square (song)	F.	Sig.
Between Groups	1.016	AD 3	339.39	3.843	12.478
Within Groups	17.67	AD 4	12.402		
Total	18.683	AD 47			

As part of the study, one-way variance analysis shows that because F is 0.843 and p is 0.478 (p=,478>0.05) growth strategies do not differ significantly from business experience. The H1d hypothesis is not supported. As a result of the Levene test in Table 10, p=0,365> 0.05, it is found that it can perform a One-Way Variance Analysis.

Table 11. Growth Strategies Anova for Activity in Technopark

	Sum of Squares	df	Mean Square (song)	F.	Sig.
Between Groups	2.170	AD 4	12.543	1.413	246.26
Within Groups	16.512	AD 43	384.34		
Total	18.683	AD 47			

Table 10. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Growth strategy	1.109	AD 4	AD 43	365.36

As per Table 11 under the study, due to the fact that the F-value is 1,413 and p is 0.246 (p=0,246>0,05) growth strategies do not differ significantly from the operating time in the technology park. The H1e Hypothesis is not supported.
Independent Sampling t-Test Results

Table 12. Test of Homogeneity of Variances

		Levene's Test for Variances				
		F.	Sig.	t	df	Sig. (2-tailed)
Growth Strategies	Equal variances	1.060	309.39	395.39	AD 46	695.65
	Equal variances not assumed			12.41	35.908	662.62

Examination of Table 12 above indicates that p is greater than 0.05 (p=0.05<0.695). The growth strategies of entrepreneurs do not differ materially from gender. Hence, the H1b hypothesis is not supported.

5.4. Relational Analysis Findings

The data is primarily looked at for skewness and distortion (Kurtotis) to check the normal distribution state. Although different opinions are given on the range in which the normal distribution value range should be within, this was evaluated by George and Mallery (2010), which stated that it should be within the ± 2 confidence range.

Table 13. Values for Correlation Analysis

Variables		Strategies for New and Large Markets	Marketing Manufacturing and Innovation Strategies in the Market	Growth Strategies
Your age	Pearson Correlation	-6.123	-6.024	12.052
	Sig. (2-tailed)	12.407	187.80	0.781
Your gender	Pearson Correlation	-6.080	-6.019	-.381*
	Sig. (2-tailed)	6.588	6.898	12.034
Your age	Pearson Correlation	-6.075	-6,140	6.071
	Sig. (2-tailed)	612.61	344.34	706.76
Your Training Status Your Business Experience	Pearson Correlation	6.061	12.01	-6.020
	Sig. (2-tailed)	680.60	6.949	195.95
	Pearson Correlation	3.288*	123.16	337.37
Your operating time in the Technopark	Sig. (2-tailed)	12.047	357.37	12.043
	Pearson Correlation	-6.123	-6.024	180.820

N=48 **p < 0.01 * p < 0.05

As a result of the analysis, the data is shown to have distortion and distortion in the corresponding value range, and the data distribution is understood to satisfy the assumption of normality. The results of the correlation analysis show that there is no meaningful relationship between demographics and growth strategies. Again, there is no meaningful relationship between the lower dimensions of growth strategies and demographic characteristics based on the results of the correlation analysis, but a positive association between your business experience and strategies for new and bigger markets has been found at p<0.05 meaningfulness level (r=,288*). Although the literature is different classifications, it is generally interpreted as having a strong

relationship (1,000-30), weak (.31—.49), medium (.50-.69), strong (.70-.100) (Bunny, 2006). In this case, the hypothesis H2 is rejected.

6. RESULT

Through technology parks, one of the most important activity centers of the entrepreneurial ecosystem, many benefits and support to business enable social goals — competition, quality, innovation, new markets — and, in many ways, added value to the national economy. In this way, the technology parks are important in the growth strategies of their businesses. In competitive conditions, the ability of businesses to sustain their activities in the entrepreneurial ecosystem depends on the product of accurate information and the adoption of a model for the business. And to meet that need, entrepreneurs need to be open to collaboration and always having support. In this sense, the key centers of the entrepreneurial ecosystem are the technoparks, which promote entrepreneurship, and provide a sustainable environment of development, providing a variety of benefits and amenities and information sources, and driving huge change and development, both locally and globally.

This research analyzes the growth strategies and differentiation of entrepreneurial firms in technoparks based on demographic factors. As a result of these analyzes, the majority of participants were between 30 and 40 years old, and male participants were more than twice as likely as female participants. As a level of training, participants are often found to be pre-licensed and licensed, with businesses that are only recently established in terms of experience. Most of the participants were found to have a total time of 0-2 years. Participants appear to have answered a significant number of questions. It doesn't matter; they don't seem to prefer it. Participants' preferences for growth strategies have shown no meaningful variation. Participants favored both growth strategies by almost the same margin. Arguably, the strategy for new and big markets is more favored. However, the results of the analysis show that participants' growth strategies do not vary according to demographic preferences.

In light of this data, it has been concluded that young entrepreneurs in the technopark, who are young entrepreneurs who are new in their fields, have not differed in their growth strategies, and that participants have remained undecided in their growth strategies. The strategies that companies determine today are an important measure of their future. Firms aware of their preference for growth strategies move forward, taking safer steps into the future. In this context, the ability of technoparks to outline their growth strategies can be important both for the future of firms and for the continuity of technoparks, and in this sense, technoparks are focused on not only growth strategies, but also particularly in the universities where it is founded, and are involved in high interaction with consulting firms, technology companies and entrepreneurs. This gives them an innovative understanding of academic collaboration as well as providing employment opportunities for graduating students. In the context of an entrepreneurial ecosystem, the physical space provided in the technoparks, the economic stimulus and support, contributes from all directions to entrepreneurs. These reforms, which have been updated in recent years, are particularly well supported in a number of areas, including R&D, innovation, sustainability, recognizability, new products and access to new markets, although there are still some constraints and hurdles to resolve. Addressing these problems entails the introduction of technoparks, one of the most valuable centers of the entrepreneurial ecosystem, academic inclusion of all universities into the curriculum, raising awareness in the entrepreneurial community, securing university-industry cooperation, and building upon human relations

7. CONCLUSIONS

By petrographic analysis, the parent rocks of the ceramics and the rock fragments and minerals in the additives were divided into groups. According to these data, answers were sought for these questions, whether their possible sources were local or brought from outside. In this regard, firstly, the geological formations of the region and the formations related to the production places of the ceramics known to be produced in different regions were determined.

The question of whether the artifact found in archaeological studies was produced in that region, whether it was local or came from outside, is important. The answers to these questions provide the basis for explaining inter-regional relations and intercultural connections. This study also sought answers to these questions and formed a source for future studies.

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Research Article

Daily Digital Currency Values Estimation Using Artificial Intelligence Techniques

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ABSTRACT: Recently, with the rapid rise in crypto money prices, Bitcoin has begun to be seen as an investment tool. Because of this trend, predictions in the digital money market gain importance. For this reason, in this study, a machine learning model was developed that can make daily predictions for Bitcoin, the most important currency in the digital currency market. An artificial neural network was used to make daily predictions for Bitcoin and the data set was designed with values from the coinmarketcap site. The next day's close price is estimated by using the open, high, low, volume, marketcap features from this site. In this study, unlike other studies, the closing price of the next day was tried to be estimated. Thus, a model has been developed that makes a value estimation that the investor will need. While creating the data sets, 300 days of data were used. In addition, considering the changes in the Bitcoin market, 3 different data sets were created as easy, moderate and hard. In this study, 0.9949, 0.9908 and 0.9503 R values were obtained in the test data sets of easy, moderate and hard difficulty levels, respectively. 70% of the data set was used for training. 15% of the data set was used to test the model. The remaining samples were used for validation. Considering the results obtained in the study, it was concluded that the estimation of Bitcoin closing values can be made daily using machine learning methods. In addition, it has been observed that there is a serious decrease in success rates on days when the price changes are too much.

KEYWORDS: Crypto-currency, Machine learning, Artificial neural networks

1. INTRODUCTION

Since the first years of humanity, money has been used to buy goods and services. Recently, the concept of money has evolved and the concept of digital money has gained importance (Li & Wang, 2017). Cryptocurrency is defined as a digital currency that uses blockchain technologies to secure money exchange transactions and approve these transfers. Cryptocurrencies have a decentralized and distributed structure, unlike centralized electronic currency generated by central banks or banking systems (Zhang et al., 2018). This distributed control structure is carried out with block-chain technology. (Chowdhury et al., 2020). These cryptocurrencies are used today in cash flows and the exchange of goods of some companies. As a result, in recent years, various studies have been carried out by researchers and scientists to model the price of cryptocurrencies and create real decision support systems (M. et al., 2020, Chen et al., 2020, Altan et al., 2019, Alessandretti et al., 2018, Akyildirim et al., 2020). Bitcoin, one of the most known and most valuable crypto currencies, is used as an investment tool today.

Bitcoin is one of the most valuable and decentralized cryptocurrencies. Introduced by Satoshi Nakamoto on October 31, 2008, Bitcoin covers approximately 35% of the total value of cryptocurrency markets (Zhang et al., 2018). Bitcoin's biggest difference is its blockchain technology, which is used to disrupt central parties' control of value transactions. Blockchain is the technology in which a record of any financial and economic transaction made in any cryptocurrency is kept using clusters of computers. Blockchain is a public data repository consisting entirely of blocks, and the security of the currency is ensured by this structure (Barkatullah & Hanke, 2015).

In addition to all these, the methods developed in the field of information technologies have enabled the effective use of data in the fields of meaning and information extraction. Machine learning algorithms, a sub-topic of artificial intelligence, are widely used in many fields such as agriculture (Gümüşçü et al., 2020, Gümüşçü et al., 2018), medicine (Gümüşçü & Tenekeci, 2018, Gerger & Gümüşçü, 2022, Gümüscü et al., 2017), economy (Altan et al., 2019), energy (Demirci et al., 2021) etc. In the field of economics, machine learning-based studies such as stock prediction (Altan et al., 2019) and credibility determination (Altan &

Demirci, 2022) were conducted. In these studies, the most well-known machine learning algorithms such as k-nearest neighbor (Keller et al., 1985), Artificial Neural Networks (ANN) (Burniston, 1994) were used.

As every investment tool, the correct determination of when to exit or enter the investment is very important for bitcoin in terms of ensuring the maximum profit from the investment. Therefore, many researchers have conducted studies on the value estimation of cryptocurrencies. Hitam and İsmail classified the value of bitcoin with an accuracy rate of 79.40% in their study (Hitam & İsmail, 2018). Chen et al. on the other hand, they classified the 5-minute bitcoin values with an accuracy rate of 67.2% (Chen et al., 2020).

In this study, the closing value of bitcoin, which is the most widely used and known cryptocurrency, was tried to be estimated the next day. In the study, 300-day bitcoin values were considered and studies were carried out with three different data sets. The reason for working with three different data sets is that the trends in bitcoin prices vary a lot and these changes can affect the prediction results of machine learning methods. For this reason, in the study, three different 300-day data sets were studied, as easy, moderate and hard. These difficulty levels have been determined by considering the 300-day change in bitcoin values. The data is taken from the coinmarketapp web page, and the next day's close price is tried to be estimated by using the open, high, low, volume, marketcap features from this site (Cryptocurrency prices, charts and market capitalizations, 2022). Thus, it is aimed to minimize the risk taken by investors.

In the article, the dataset and ANN are summarized in section 2. The results obtained are given in section 3 and the contribution of the study are highlighted in section 4.

2. MATERIALS AND METHODS

2.1. Datasets

In the study, applications have been made on bitcoin virtual currency value estimation, which has been in high demand by investors recently. For this reason, methods have been applied on the data taken from the coinmarketcap web page, which keeps the values of virtual currencies. The data set was prepared according to three different difficulty levels as easy, moderate and hard. These difficulty degrees were determined by considering the changes in bitcoin value over 300 days. It is considered easy if the trend follows a horizontal course for 300 days and considered hard if it follows a course with high changes. Table 1 shows which date ranges are taken when creating easy, moderate and hard data sets. Three difficulty levels are determined according to the changes in the 300-day closing prices trends. Trend change is determined as difficult if it has a lot of ups and downs within 300 days. The trend with average ups and downs was determined as medium difficulty.

Table 1. Data Sets Date Ranges

Difficulty Level	Start Date	End Date
Easy	02.03.2020	27.12.2020
Moderate	16.12.2021	11.10.2022
Hard	01.08.2019	27.05.2020

Figure 1 shows how daily bitcoin prices change according to the difficulty level of the data sets.

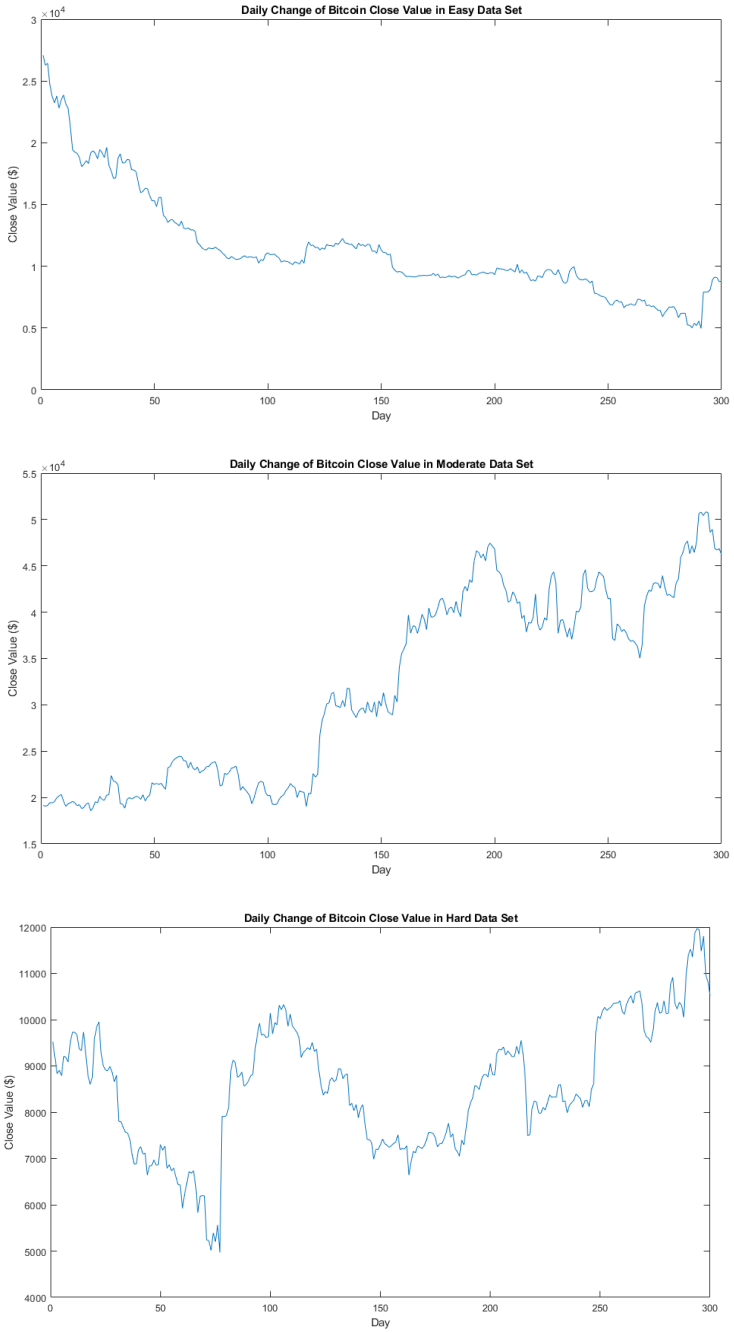

Figure 1. Daily Bitcoin Price Changes in the Data Set

In this study, it is aimed to predict the closing values of the next day by using the open, high, low, close, volume, marketcap features in the dataset. The mean and standard deviation values of the features are given in Table 2 below.

Table 2. Statistical Values of Features

Dataset	Feature	Mean	Standart Deviation
Easy	Open	1.125289e+04	4.109467e+03
	High	1.150981e+04	4.267729e+03
	Low	1.103042e+04	4.026745e+03
	Close	1.130968e+04	4.195608e+03
	Volume	3.271974e+10	1.214727e+10
	MarketCap	2.088561e+11	7.846092e+10
Moderate	Open	3.215831e+04	1.021162e+04
	High	3.280537e+04	1.039120e+04

Hard	Low	3.137620e+04	1.002679e+04
	Close	3.205889e+04	1.019263e+04
	Volume	2.981718e+10	9.869960e+09
	MarketCap	6.096467e+11	1.917306e+11
	Open	8.580044e+03	1.385316e+03
	High	8.751113e+03	1.374934e+03
	Low	8.395130e+03	1.385798e+03
	Close	8.576451e+03	1.384273e+03
	Volume	2.834769e+10	1.223527e+10
	MarketCap	1.553814e+11	2.446938e+10

As can be seen in Table 2, the value differences between the features in the data sets are very high. For example, while the average of the volume feature in the easy data set is 3.271974e+10, the average of the low feature in the same data set is calculated as 1.103042e+04. Considering that ANN will be used as a machine learning method, these value differences will negatively affect the model. Therefore, before applying the machine learning method, the values in the datasets were normalized with the formula in Equation 1.

$$X_{new} = \frac{X-\mu}{\sigma} \quad (1)$$

In equation 1, μ is accepted as the mean value of the given sequence and σ is accepted as the standard deviation of the given sequence. X is the sample to be normalized and Xnew is the normalized value of X. The variation intervals of the attributes were limited using the normalization process, and it was ensured that all features were equally weighted in the training phase of the ANN model.

2.2. Artificial Neural Networks

ANNs, inspired by human neural networks, aim to use neural network behavior in regression problems. Neurons, which are small processing units, combine to form a neural network. In addition, the weight coefficients between neurons express the strength of the connection between two neurons. During the training phase of the ANN model, these coefficients are updated according to their output values. This update is done iteratively. ANNs basically consist of three different layers: input, hidden and output layers. In the study, the number of hidden layers was taken as 10. The number of input layers is determined as 6, which is the number of features. It is also set as a single-layer structure at the output layer. In addition, scaled conjugate gradient algorithm was used in the training phase (Møller, 1993).

In this study, 70% of the data set was used to create the ANN network. 15% of the data set was used to test the success of the model. The remaining samples were used for validation.

3. RESULTS and DISCUSSION

In this study, bitcoin value estimation was made using ANN and experimental studies were carried out on the dataset with 3 different difficulty levels.

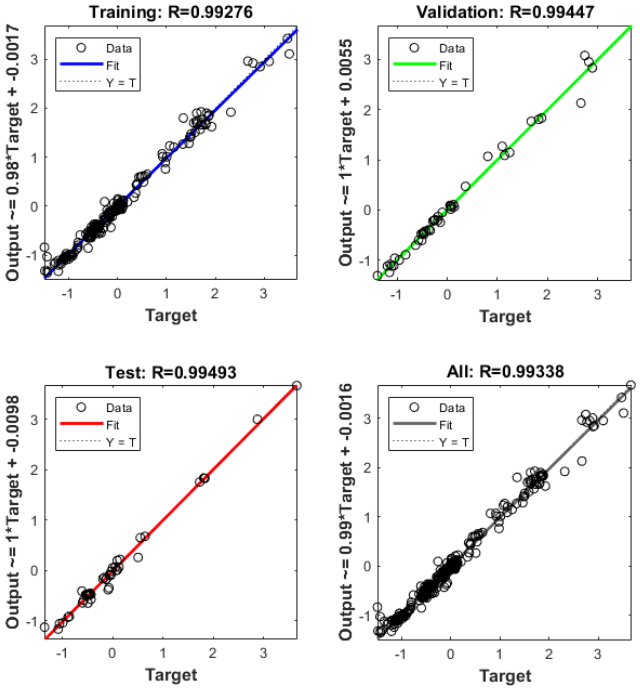

Figure 2. Result Graphs in Easy Dataset

In the easy dataset, the success rates in Figure 2 are provided in the training, testing and validation datasets. In the Moderate data set, ANN success graphs were obtained as in Figure 3.

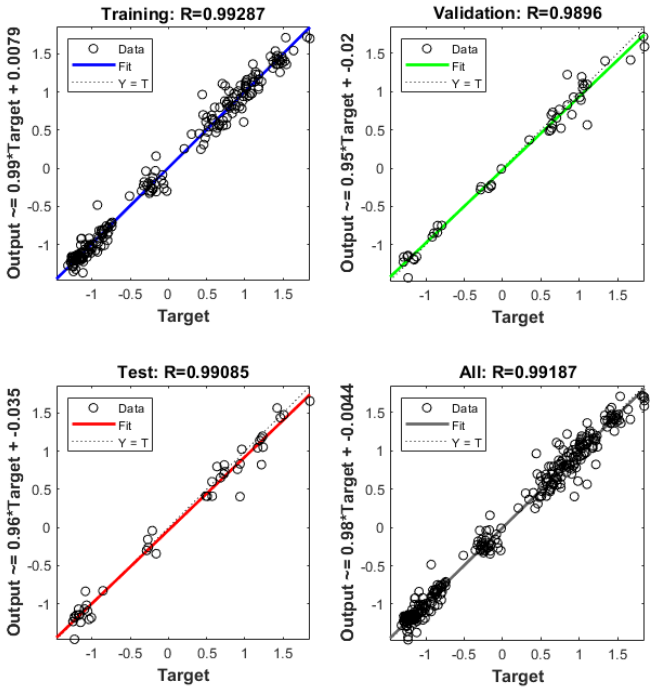

Figure 3. Result Graphs in Moderate Dataset

As can be seen in Figure 3, a success rate of 0.99 was obtained in the moderate test data set. In the hard data set, machine learning success graphs were obtained as in Figure 4.

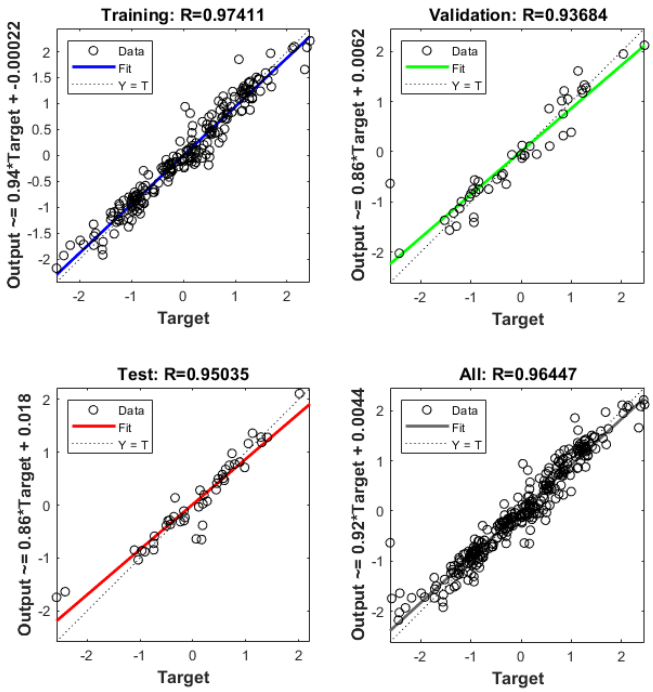

Figure 4. Result Graphs in Hard Dataset

As can be seen in Figure 4, a success rate of 0.95 was obtained in the hard test data set. In addition, the lowest success rate, 0.93, was obtained in the validation data set. In Table 3 below, the success rates obtained in the study are summarized according to the degree of difficulty.

Table 3. Obtained R success rates

Dataset	Training	Validation	Test
Easy	0.9927	0.9944	0.9949
Moderate	0.9928	0.9896	0.9908
Hard	0.9741	0.9368	0.9503

4. CONCLUSIONS

In this study, in order to observe the usability of artificial neural network methods in solving the next day value estimation problem of bitcoin crypto currency, it was carried out with three different difficulty levels as easy, moderate and hard.

Considering the results obtained, the value estimation made at easy and moderate difficulty levels was found at acceptable levels. In this case, it can be said that the closing price of the next day is predictable on days when bitcoin prices follow a horizontal course. In addition, when the difficult data set is considered, lower success parameters were obtained compared to the other difficulty levels.

Thus, it has been concluded that it is possible to successfully predict the value of cryptocurrencies using machine learning methods, and future studies will focus on a more difficult task such as five minutes-based cryptocurrencies value estimation.

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Author's Contributions

Data was collected from coinmarketcap by Ahmet Tabanlıoğlu. Conceptualization, formal analysis, methodology, and writing were performed by Ahmet Tabanlıoğlu and Abdülkadir Gümüşçü. Software was organized by Ahmet Tabanlıoğlu. Review & editing was organized by Abdülkadir Gümüşçü.

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Research Article

Comparison of Frankel Scale with Apache-II Scale in the Prediction of Early Stage Mortality of Cervical Spinal Cord Injury

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ABSTRACT: Cervical spinal cord injury (CSCI) is a devastating event that can cause not only motor and sensory impairments but also autonomic dysfunction. Functional and morphological changes in the autonomic nervous system can also affect the respiratory, cardiovascular, renal and gastrointestinal systems. In our study, APACHE-II and Frankel Scale were used. The revised acute physiology and chronic health assessment system (APACHE-II) is a physiologically-based scale that includes 12 physiological parameters. The Frankel Scale was developed in 1969 by Dr. Frankel and is considered to be the pioneer of the ASIA scale for staging of Spinal Cord Injury. In this study, 47 patients who had cervical spinal cord injury between 2016 and 2020 were retrospectively analyzed. The patients were treated within 24 hours of their admission to the emergency department. Each patients APACHE-II and Frankel scores were measured and analyzed with SPSS in terms of sensitivity, specificity, and mortality prediction.

Cervical spinal cord injury is a devastating event that can cause not only motor and sensory impairments, but also autonomic dysfunction. Functional and morphological changes in the sympathetic nervous system can also affect the respiratory, cardiovascular, renal, hematological and gastrointestinal systems. These systems can be affected more than lower level spinal traumas. Therefore, patients with cervical spinal cord injury were evaluated according to both Frankel and APACHE-II classification systems in terms of mortality prediction.

KEYWORDS: APACHE II, Frankel Scale, Cervical Spinal Cord Injury, Classification, Mortality

1. INTRODUCTION

Cervical spinal cord injury (CSCI) is a devastating event that can cause not only motor and sensory impairments but also autonomic dysfunction. Functional and morphological changes in the autonomic nervous system can also affect the respiratory, cardiovascular, renal and gastrointestinal systems. The predictability of mortality that may result from autonomic nervous system damage in patients from the onset of trauma, which we will consider as the early stage of CSCI, to the first moment of surgery, is of vital importance in the correct planning of the surgery to be performed and postoperative follow-ups. The early phase of CSCI covers a very limited time frame due to the possibility of worsening the clinical picture and the need for appropriate treatment as soon as possible. The initial neurological examination is the most important tool to assess the severity and level of the injury. For optimum reliability of the initial exam, the patient must be able to cooperate and follow the examiner's instructions. Since its introduction in 1969, the Frankel scale, a 5-point severity scale, has been widely used to determine injury severity. Therefore, the prediction of mortality at this stage is of vital importance and must be done immediately.

In our study, it was aimed to show that the Frankel scale can be a method that can be performed in a much shorter time compared to the APACHE-II scale in the early stage after CSCI, easy to communicate between the emergency doctor and neurosurgeon, and has a high mortality predictive value.

2. MATERIALS AND METHODS

In our study, APACHE-II and Frankel Scale were used. The adjusted acute physiological and chronic health evaluation system (APACHE-II) is a physiological-based scale with 12 physiological parameters. Frankel Scale, on the other hand, was developed by Dr. Frankel in 1969 and is considered to be the pioneer of the ASIA scale in Spinal Cord Injury staging. In this study, 47 patients who had cervical spinal cord injury between 2016 and 2020 were retrospectively analyzed. This study was approved by the Institutional Review Board (TUEK E1-22-2953), and written informed consent was obtained for each patient. The patients were treated within 24 hours of their admission to the emergency department.

2.1. Patient Selection

In this study, 47 patients who had cervical spinal cord injury between 2016 and 2020 were reviewed retrospectively. The patients were treated within 24 hours of their admission to the emergency department. Patients who stayed in the intensive care unit for less than 24 hours, patients younger than 16 years of age, and patients whose records lacked data to calculate scores were excluded from the study. APACHE II and Frankel scores were calculated for each patient. All physiological measurements were scored over the value that deviated the most from normal in the first 24 hours. In addition to all these variables, the patient's diagnosis, duration of intensive care and hospital stay, and 6-month mortality were learned from the patient files. The SPSS statistical program was used to evaluate the sensitivity, specificity, and mortality prediction.

2.2. Data Analysis

Table 1: Patient characteristics and clinical presentations

		n	%
Sex	Female	13	27,6
	Male	34	72,4
Age (years)*			45,7 (21– 82)
Age of patients who died			57.81±14.36
Length of stay in ICU			9.00 ±13
Frankel Score	A	10	21,2
	B	2	4,2
	C	3	6,3
	D	14	29,7
	E	18	38,2
Death		9	19,1
APACHE II Score			13,1±15,59
ROC Analysis for APACHE II			0,82

*: Mean ± Standard Deviation / Median (Min – Max)

SPSS statistical program was used for statistical evaluation. Mana-Whitney U, Wilcoxon, Kruskal Wallis test was used for statistical analysis. $p<0.05$ was considered significant.

3. RESULTS

The study included 34 male and 13 female patients. The ages of the patients ranged from 21 to 82 (Mean 45,7). There was no statistically significant difference in terms of gender distribution between discharged and deceased patients ($p>0.05$). The mean age of patients who died is 57.81±14.36. The length of stay in the intensive care unit was 9.00 ±13 (1-175) in those who were discharged, and 6±9 (1-280) in those who died. Ten patients were Frankel A, 2 patients B, 3 patients C, 14 patients D, and 18 patients E. Nine patients died, 38 patients were discharged after treatment. The average Apache II score was 13,1±15,59. The Apache II score in deceased patients was 41±12,7. The efficacy of scoring systems in determining ICU mortality was investigated using the "receiver operating characteristic curve" (ROC curve). In comparison of scores, the area under the curve in the ROC analysis was calculated (the value must be between 0,5-1,0 for it to be significant; 1,0 indicates the most significant relationship). An APACHE II score above 13,5 (the threshold value determined by ROC analysis) had a sensitivity of 81,5% and a specificity of 75,9% in determining mortality. The area under the curve in the ROC analysis for the APACHE II score was calculated as 0,82 (95% CI: 0,778-0,845). All 9 patients who died were Frankel grade E. When evaluated with the Pearson correlation test, it was found that the scoring systems did not have a relationship with the length of stay in the intensive care unit, but the relationship between the length of hospital stay and the APACHE II and Frankel Scoring was significant. Frankel scale as well as APACHE-II were found to be successful in predicting mortality.

4. DISCUSSION

Evaluating cervical spinal cord injuries not only as neural tissue damage but also as a systemic disease is important for the prognosis of the patient. In the acute phase, atelectasis, pneumonia, deep vein thrombosis, cardiac arrhythmias, pulmonary embolism, autonomic dysreflexia, orthostatic hypotension, bladder and bowel problems are important causes of morbidity and mortality. Especially in elderly patients and patients with chronic diseases, morbidity and mortality rates due to systemic complications are observed at higher levels in cervical spinal cord injuries. Ischemic heart disease, hypertension, heart failure, diabetes mellitus, Parkinson's disease, hypothyroidism, cerebrovascular diseases, motor neuron disease, osteoporosis and osteomalacia are diseases that are more common in elderly patients. It is obvious that the presence of these diseases before trauma will lead to serious post-traumatic complications and systemic disorders, leading to an increase in mortality and morbidity rates.

Mortality scoring systems have been developed and used for various purposes in intensive care patients. Their primary aim is to discriminate patients according to their probability of mortality. In addition, the observed mortality rate versus the expected mortality rate is frequently used in the evaluation of the clinical performance of intensive care units.

In the presence of a neurological deficit, the expression of the neurological status is usually made according to the Frankel scale. According to this classification, A: Complete motor and sensory loss (Muscle strength: 0), B: Complete motor loss - sensory normal (Muscle strength: 0), C: Useless motor activity (Severe paresis)-sensory normal (Muscle strength: 1 -2), D: Functional motor activity (Mild paresis)- normal sensation (Muscle strength: 3-4), E: Normal motor activity and sensory function (Muscle strength: 5). The prognosis is considered poor in Frankel A and B and good in C and D and E. However, ignoring the pre-existing diseases that may affect the prognosis of the patient will cause deficiencies in patient follow-up and treatment to be overlooked.

The revised acute physiology and chronic health assessment system (APACHE-II) is a physiological-based scale that includes 12 physiological parameters, was first defined by Knaus and has been used in intensive care units since 1985 (Knaus et al., 1985). The overall evaluation score of APACHE II is 71. The acute physiology score consists of 3 parts: age and chronic health assessment. The sum of the acute physiology score, which includes parameters such as blood pressure, blood pH value, Glasgow coma score (GCS), varies between 0-60. Scoring includes the same parameters of chronic health assessment with scoring from 0 to 5 (Knaus et al., 1985; Cho et al., 1999).

It has been determined that respiratory, cardiovascular, renal and gastrointestinal complications and, in the last period, hyponatremia and hematological disorders contribute to the poor prognosis after cervical spinal cord injury (Frankel et al.,1969).

Respiratory complications are the most common cause of mortality and morbidity in cervical spinal cord injury, with an incidence ranging from 36% to 83%. 80% of deaths in hospitalized patients are secondary to pulmonary dysfunction, and pneumonia is the cause in 50% of these cases. The 4 main reasons that contribute to 60% of hospital costs are the use of mechanical ventilation, the occurrence of pneumonia, the application of surgery and the need for tracheotomy (Carter et al., 1987; Lemons et al.,1994; Kiwerski et al.,1992).

The most common complications in the first 5 days after cervical spinal cord injury are atelectasis (36,4%), pneumonia (31,4%) and respiratory failure (22,6%). Respiratory failure is the earliest complication that occurs after an average of 4,5 days after injury and ends in an average of 5 weeks (Jackson et al., 1994). In the study of Claxton et al., which included 72 patients with traumatic cervical spinal cord injury, the need for mechanical ventilation due to respiratory failure was found at a rate of 36%, and the need for mechanical ventilation was found in 90% of them within the first 3 days after the injury(Claxton et al., 1998). In the retrospective study of Waters et al. including 941 cases with spinal cord injury, the incidence of pneumonia and atelectasis in tetraplegic cases was found to be 45% (Waters et al., 1999).

The rate and type of respiratory complications vary with the level of injury and motor grade. The incidence of respiratory complications was 84% in injuries at the C1-C4 level and 60% at the C5-C8 level. While pneumonia and atelectasis were the second most common in C1-C4 level injuries, atelectasis was the 2nd and 3rd most frequent, respectively, pneumonia and respiratory failure were seen in C5-C8 level injuries (Jackson et al.,1994).

One of the important complications developing in spinal cord injuries is gastrointestinal system problems. The most important complication that can be seen in the first 48 hours is paralytic ileus and it manifests itself with abdominal distention and dehydration. In cord injuries above the thoracic 6 segment, unlocalized abdominal discomfort, increased spasticity, and autonomic dysreflexia are observed (Clinton et al.,2005).

Other symptoms seen in cervical spinal cord injuries include dysphagia, gastric hypersecretion and dilatation, gastrointestinal stasis, anal incontinence and constipation. In addition, fluid electrolyte imbalances occur due to deterioration in intestinal motility and permeability, and the rehabilitation process and quality of life are adversely affected (Tong et al., 2009).

Basal gastric motility and esophageal-gastric relaxation reflex decrease after spinal cord injury independent of damage to sympathetic innervation. As a result, gastric stasis and reflux occur. This increases the risk of aspiration of gastric contents. Influence of spinosoliter afferent fibers is effective in the occurrence of gastric stasis. The vago-vagal reflex pathways are active from the oral cavity to the proximal 1/3 of the colon. In general, gastric and intestinal reflexes are under the control of vago-vagal reflexes via the medulla (Tong et al., 2009).

The parasympathetic innervation of the distal colon and rectum is provided by the S2-S4 spinal segments, and the sympathetic innervation is from the lumbar spinal segments, and these extrinsic neural pathways are necessary for colonic motility. However, in studies on gastrointestinal reflexes, although no changes were detected in colorectal, rectocolic and gastrorectal reflexes compared to healthy people, a delay was found in the gastrocolonic reflex. Providing colorectal, rectocolic and gastrorectal reflexes by intrinsic (local) neural pathways, as well as vagal and neurohormonal (for gastrocolonic reflex) pathways have an effect on the protection of these reflexes. The decrease in the gastrocolonic reflex is thought to be secondary to gastroparesis, although unlikely. Although colorectal activity is preserved, it has been reported that anorectal dysfunction has a small share in the resulting constipation. It has been reported that digitization has a potential effect on the initiation of defecation (Suttor et al., 2009).

Another complication that may affect the prognosis in cervical spinal cord injuries is cardiovascular problems. Cardiovascular complications that can be seen in the acute phase are sinus bradycardia, loss of vascular tone, supraventricular-ventricular ectopic beats, arterial hypotension, increased vasovagal reflex sensitivity, vasodilation, and venous stasis.

Parasympathetic innervation of the cardiac region is provided from the brain stem region via the vagus, while sympathetic innervation is provided from the T1-5 segments. Acute loss of sympathetic stimulation causes bradycardia and arterial hypotension (neurogenic shock). Hypersensitivity in the vagus ends in approximately 2-3 weeks. It is important to avoid vagus stimulation during this period. Hypoxia, nasogastric and endotracheal tubes can also cause vagal reflexes to start. In emerging bradycardia, atropine is the drug of choice (Hagen et al.,2012).

Autonomic dysreflexia occurs in injuries above the T6 level. This occurs with the induction of sensory stimulation under the injury site and develops within the first 2-4 months. Paroxysmal hypertension often occurs accompanied by baroreflex-mediated bradycardia. In 85% of the patients, the reason is full bladder due to retention or catheter blockage. A 20-40 mm Hg increase in systolic pressure should be considered as a sign of autonomic dysreflexia. Nifedipine and captopril are effective in its treatment (Hagen et al.,2012).

Deep vein thrombosis and related pulmonary thromboembolism are also important in mortality and morbidity. Therefore, patients should be started on low molecular weight heparin therapy for the first 3 months (Chung et al.,2011).

In the long term, decreased physical activity and autonomic dysreflexia predispose to coronary artery disease. Cardiac arrhythmias such as orthostatic hypotension, bradycardia and A-V block are among the common causes of mortality and morbidity. Decreased high-density lipoprotein, high total cholesterol and low-density lipoprotein, increased C-reactive protein, obesity, smoking, diabetes, and insulin resistance are predisposing factors for cardiac complications (Myers et al.,2007).

Two active pathways have been defined between the immune system and the central nervous system: the hypothalamus-pituitary-adrenal pathway and the autonomic nervous system. Sympathetic-noradrenergic and, to a lesser extent, sympathetic-neuropeptide-Y innervation is effective on primary and secondary lymphoid tissues. The loss of control of the autonomic sympathetic system over the lymphoid organs also causes hematological changes. Decreased hemoglobin concentration, leukocytosis, lymphopenia, and thrombocytopenia in the first 1 week post-traumatic are frequently seen after isolated cervical spinal injury. As the degree of spinal cord damage increases, the decrease in hemoglobin concentration and lymphopenia become more pronounced. In addition, when the cases with methylprednisolone use are compared with those who do not, there is no significant difference in the occurrence of leukocytosis, but it is stated that lymphopenia is more pronounced in cases where methylprednisolone is used (Furlan et al.,2006).

Hyponatremia is the most common electrolyte imbalance in the first 2 weeks after cervical spinal cord injury. The reason for this is hypotension secondary to vasodilation, increasing the release of antidiuretic hormone from the paraventricular nuclei in the hypothalamus and disruption of the integrity of the descending renal sympathetic pathway (Furlan et al.,2006). In addition, spinal cord damage causes a decrease in glomerular filtration rate, leading to deterioration in renal functions. This decrease is more evident in complete cord injuries in the cervical and thoracic regions (Pettersson-hammerstad et al.,2008). In addition, there is a risk of developing vesicoureteral reflux and hydronephrosis in patients who empty their bladders with Valsalva or Crede maneuvers (Subramanian et al., 2012).

It should be taken into account that these complications, which may develop due to spinal cord injury in patients with pre-traumatic chronic disease or in advanced age, may develop at more frequent rates and/or in more severe degrees.

Frankel scale is an evaluation method that should be applied in terms of expressing the degree of cord damage in a simple language. However, since the APACHE II scale gives more detailed information about the general condition of the patient, it is an undoubted fact that it will provide more detailed information about the prognosis of the patients. Our study showed that the communication between the emergency physician and the neurosurgeon is as reliable as the APACHE II, with its predictability of mortality in the early stage and the more practicality of the Frankel scale in the planning of patient treatment without wasting time. In addition, the evaluation of APACHE II parameters by the team that will follow and treat the patient after the early stage is also necessary in order to determine possible complications that may develop.

5. CONCLUSION

Damage to the autonomic system causes respiratory, cardiovascular, renal and gastrointestinal complications, and these systems are thought to be the most commonly affected after cervical spinal cord injury. Recently, hyponatremia and hematological disorders have also been found to contribute to poor prognosis after cervical spinal cord injury. Although APACHE-II, which includes 12 physiological parameters, is thought to be effective in predicting mortality due to mutlisystemic dysfunction after cervical spinal cord injury, we found that the Frankel scale, which is cheaper and easier to apply, is at least as valuable as it. The small number of cases and the fact that only one APACHE-II measurement was made at the time of admission are the weaknesses of this study. More detailed studies on this subject should include hospital follow-up values, so we think that comparison with other scales will be more valuable in the evaluation of mortality and prognosis. Because the Frankel scale is simple and functional, it is still a common language between the emergency doctor and the clinician.

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Research Article

Provenance of Kinet Höyük Ceramics Uncovered in Excavations: Petrography, XRF and Raman Analysis

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ABSTRACT: The archaeological finds unearthed at Kinet Höyük are a sensitive indicator of the forces that shaped the economic relationship in the Eastern Mediterranean during these centuries. Among the archaeological finds, pottery is especially important evidence for the determination of cultural and economic relations at important chronological moments.

Petrographic, XRF (X-rays fluorescence) and Raman analysis techniques were used to determine the mineralogical-petrographic and chemical contents of the pottery selected from stratified levels dating to the Bronze Age, Iron Age and Hellenistic Period unearthed during the excavations at Kinet Höyük and clay samples taken from the environment. It was determined that some of the studied samples were compatible with the samples taken from the regional geological formations and clay beds, and it was determined that they were local production.

KEYWORDS: Kinet Höyük, Ceramics, Provenance, Petrographic, XRF, Raman

1. INTRODUCTION

Kinet Höyük is an important port settlement (Figure 1). located near the town of Dörtyol in Hatay province. Excavations on the mound and surrounding fields recovered an occupational sequence from Early Bronze II through the Hellenistic Period, accounting for thirty-two phases with multiple subdivisions and no notable gaps. The Early Bronze, Middle Bronze, and Late Bronze to Iron Age exposures were carried out in three separate areas, but firm stratigraphic overlaps connect them to form an unbroken sequence applicable throughout the site. Twenty years of archaeological research at Kinet Höyük were carried out as a Bilkent University project directed by M.-H. Gates (1992-2012).

Samples excavated at Kinet from five chronological time frames of the Bronze, Iron and Hellenistic occupations were selected from Phases VI (Early Bronze), V (Middle Bronze), IV (Late Bronze), III. (Early Iron) and II (Hellenistic). Mineralogical, petrographic and chemical analyses were conducted on them. This study was supported within the scope of Kastamonu University Scientific Research Projects with Project number KÜ-BAP01/2020-80.

Petrographic, XRF (X-rays fluorescence) and Raman analysis were made to answer different research questions determined according to the specific periods of excavation and their archaeological components.

In addition, the pottery produced and imported in Kinet Höyük during five chronological time frames of the Bronze, Iron and Hellenistic was defined and regional pottery activity was understood. The results obtained will contribute to the understanding of the commercial, economic and cultural relations of Kinet Höyük with the Aegean, Mediterranean, Syria and Anatolia in these periods and the geographical dimension of this relationship, and will form a database for future similar studies.

[1] In the coding, **KHK** (=Kinet Höyük Excavation), **B1** code refers to the ceramic sample no 1. Clay/torak samples taken from the environment were coded as **KHK-D.**

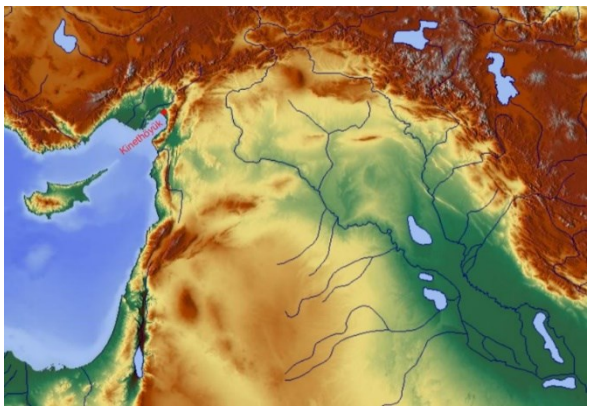


Figure 1. Kinet Höyük (Ceyhan, Erzin and Arsuz Plains) and their location in Near East, physical map (https://maps-for-free.com/)

2. MATERIALS AND METHODS

A total of 240 pottery sherds were sampled from the layers dated to the Early, Middle, Late Bronze Age and Iron Age, together with the Halaf and Ubaid (Late Neolithic-Early Chalcolithic) periods, in order to determine the early period of the Early Bronze Age samples and their relationship with their first production. Care was taken to ensure that the samples selected from different strata were sufficient to represent the group from which they were taken in terms of their functional and cultural characteristics. Before proceeding to the analysis phase, information such as the location, period, pottery shape and paste texture of each sample was recorded, and a documentation was made by taking photographs of each sample.

20 clay samples taken from Kinet Höyük and the surrounding area were marked on the location map (Figure 2)[1].

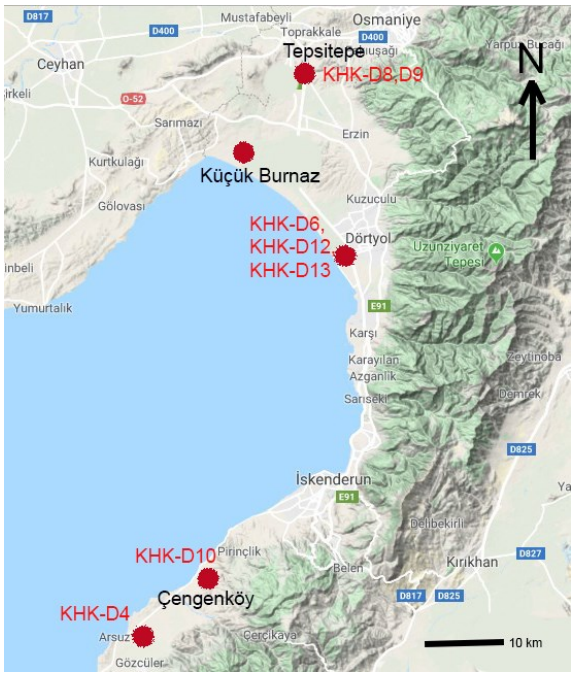


Figure 2. Location of clay samples taken from Kinet Höyük

In this study, SPECTRO X-Lab 2000 brand spectrometer works in the Polarized Energy Dispersive X-Ray (PEDX) system. For analysis, 4 g powder samples were taken from the pottery samples. After the powder samples were pressed into pellets with a diameter of 35 mm, they were analyzed by wavelength dispersion XRF. With the XRF method, the concentrations of many elements with atomic numbers between Be and U elements can be obtained.

The concentrations of major (> 1% wt) and minor (between 1% - 0.01%wt) elements found in the pottery samples were calculated as percent oxide, and the concentrations of trace elements (<0.01%wt) were calculated as ppm. In theory, major and minor oxide concentrations provide a general data on the raw material used in the production of pottery, while similarities and differences in trace element concentrations are a more sensitive indicator. The concentrations of major, minor and trace elements in the samples were evaluated together and the geochemical fingerprints of the analyzed pottery were revealed.

Raman spectroscopy relies on measuring the scattered beam from a specific angle by irradiating a sample with a powerful laser source consisting of a visible or near-IR monochromatic beam. In Raman experiments, a monochromatic light beam is sent into the sample. When molecules interact with an intense monochromatic beam, most of the light is scattered as it passes through the molecule. During light scattering, the energy of most of the scattered light is equal to the energy of the light interacting with the matter, and this type of elastic scattering is called Rayleigh scattering. Point analysis, line length analysis, mapping and intensity analysis can be performed with Confocal Raman Spectrometer. In general, point analysis is applied in mineralogical determinations (Deniz, 2010; Güllü and Deniz, 2022).

Confocal Raman Spectrometer (CRS) measurements were made on Thermo Scientific brand DXR model devices.
Pyroxenes in ceramics and clay were measured in the form of point analysis using a 633 nm laser with a resolution of 2 cm-1 and a range of 100–1200 cm-1 (Deniz, 2021; Deniz and Kadıoğlu, 2021).

After the sampling and documentation phase, thin sections were prepared from the pottery samples and the thin sections were analyzed using an polarizing microscope. With thin section analysis, it is aimed to obtain technical data on the raw materials used in the production of pottery, raw material processing techniques, and production stages such as shaping and firing. Thin section analysis is a widely used method in the examination of archaeological finds. In addition to the pottery, other ceramic finds and samples taken from materials such as stone, mortar, plaster and mudbrick are also examined by thin section analysis.

A small piece cut from the pottery sample was glued to a glass microscope slide and the etching process was carried out until the thickness of this piece was reduced to 30 micrometers. When the thickness of the sample on the glass reaches 30 micrometers, the sample preparation process is completed by covering the sample with a second thin glass slide. The components (such as minerals and rock fragments) in the pottery sample become transparent to light at a thickness of 30 micrometers and can be identified and separated from each other according to their optical characteristics by examining them under a microscope. Sections of Kinet Höyük ceramic and clay samples were prepared and studied (Figure 3).

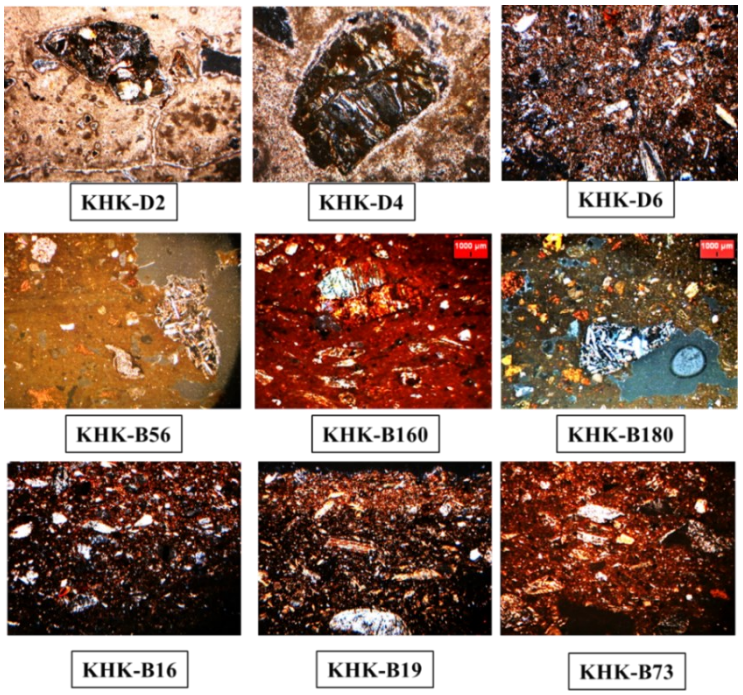


Figure 3. Kinet Höyük excavation ceramics and clay thin section samples

3. RESULTS and DISCUSSION

240 examples belonging to different periods were examined. Petrographic analysis was performed in all samples. XRF analysis was performed on selected eighty samples from the groups formed at the end of the petrographic analysis.

3.1 X-Ray Fluorescence (XRF) Analysis

XRF analysis was carried out to determine the chemical contents of selected samples from Kinet Höyük according to the results of petrographic analysis from different periods and clay/soil samples taken from the environment (Figure 4, Table 1).

According to the data obtained from the clay beds and the origin rocks of the ceramics, the geological formations around Kinet were determined first[2].

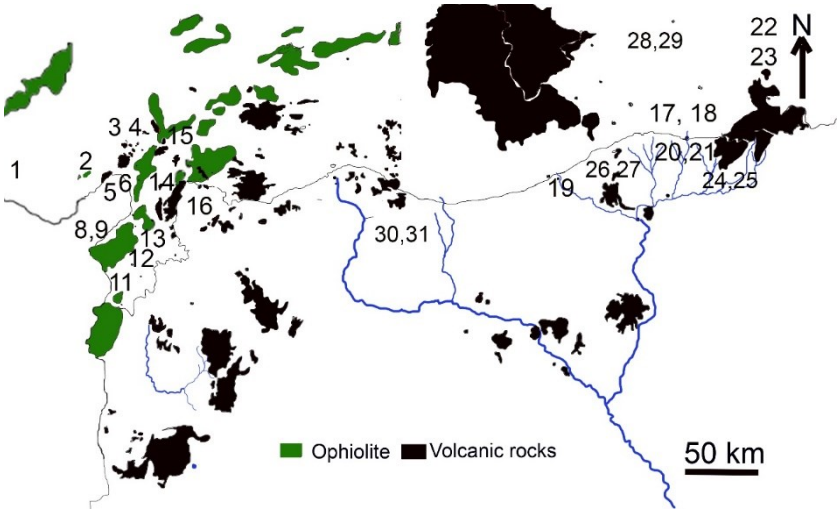


Figure 4. Clay samples from Ceyhan, Erzin, Arsuz, Amuk, Gedikli, Northern Syria Regions (Kibaroğlu, 2008, 2015) and geological formations (Sarıfakılıoğlu et al. 2017 and Türkecan, 2015, Lustrino, et al. 2006. publications)

After determining the regions where ophiolite and basalt formations are seen, the chemical contents of the clay/soil samples taken from these regions from previous studies and within the scope of this study were determined (Figure 4, Table 1).

Table1. Comparison of MgO, Al203, SiO2, Ca0, Fe2O3 and Cr2O3 values of clay samples from Ceyhan, Erzin, Arsuz, Amuk Plain, Gedikli, Northern Syria Regions (Kibaroğlu, 2008,2015 and Gutsuz 2017)

Element	Tarsus (D3)	Sirkeli	Sirkeli	Sirkeli aver.	Sirkeli Clay	Tepsitepe (D8)	Tepsitepe D9	Deliçay D12	Deliçay D13	Yeşilköy D6
Clay Sample Points	**1**	**2a**	**2b**	**2c**	**2d**	**3**	**4**	**5**	**6**	**7**
MgO	2,4	3	9,5	6,25	8,2	24,7	19,9	25,9	23,8	11,9
Al_2O_3	9,1	8,6	15,7	12,1	13,1	4,32	4,5	2,93	4,3	5,1
SiO_2	50,9	41,4	57,1	49,2	44,1	56,01	50,7	45,7	49,6	42,1
CaO	9,6	14	33	23,5	20,9	4,5	8,01	9,29	8,4	5,3
Fe_2O_3	6,1	4,6	9	6,8	9	7,4	7,2	5,8	5,7	5,9
Cr_2O_3	0,04				818	0,1	0,15	0,14	0,12	0,1

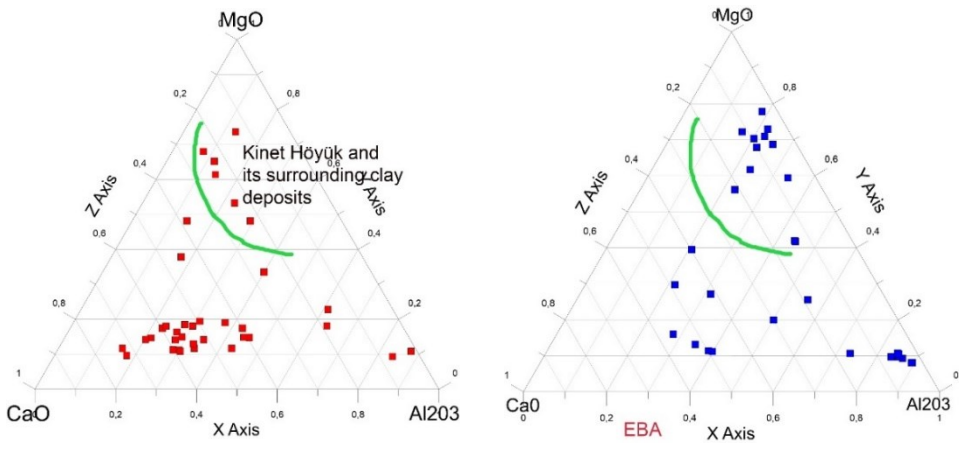
[1] **Ophiolite:** Serpantinit, amfibolit, spitilik bazalt, gabro, diyabaz, radiolaria, pelajik limestone, **Delihalil form. (Qd):**Alkaline Basalt, **Haydar form. (Th):** Serpentinite and limestone contain little quartz and chert pebbles, conglomerate and occasional marl. **Bulkurkaya (Tbul):** Recrystallized limestone and volcanic and ophiolite blocks are located in a debris flow complex mostly composed of serpentinites and volcanic rocks (gabro, basalt, spilite, andesite). In addition, sparse marble blocks contain secondary micaschists (Doyuran, 1982).

Element	Çengen D10	Arsuz D4	Arsuz Kil 1	Arsuz Kil 2	Asi Nehri	Asi Nehri	Karasu	Karasu	Kırıkhan	Kırıkhan	Tilmen	Tilmen
Clay Sample Points	**8**	**9**	**10a**	**10b**	**11a**	**11b**	**12a**	**12b**	**13a**	**13b**	**14a**	**14b**
MgO (%)	5,7	11,6	8,03	7,06	6,4	7,8	4,8	9,5	17,9	14,8	3,8	2,2
Al_2O_3	7,5	5,3	12,1	11,7	8,7	10,1	12,9	11,3	5,0	9,0	13,5	20,5
SiO_2	43,7	41,5	45,4	50,2	36,0	45,4	67,6	61,4	51,2	58,5	61,3	58,8
CaO	19,7	13,8	23,3	20,3	39,9	25,2	3,4	7,5	14,2	6,9	4,01	1,6
Fe_2O_3	5,0	4,6	6,9	6,2	6,1	8,5	6,3	6,5	8,1	7,3	11,2	9,5
Cr_2O_3 (ppm)	544	688	332	610	650	1420	610	960	2710	1180	1010	239

Element	Almanpınarı	Afrin	Afrin	Kamışlı	Kamışlı	Habur	ÇağÇağ 1	ÇağÇağ 2	İdil
Clay Sample Points	**15**	**16a**	**16b**	**17**	**18**	**19**	**20**	**21**	**22**
MgO	1,9	4,2	6,1	4,42	7,3	4,8	5,5	4,7	3,6
Al_2O_3	15,9	11,4	12,1	11,2	10,7	12,3	7,9	11,6	10,1
SiO_2	58,5	52,8	57,1	48,5	37,7	50,1	31,2	42	51
CaO	0,25	22,3	14,0	23,6	32,1	20,4	25,7	17,1	19,4
Fe_2O_3	8,0	6,5	7,8	5,71	5,1	6,2	4,1	6,1	4,8
Cr_2O_3	200	510	1050	342	206	277	187	254	533

Element	İdil	Jarah	Jarah	Tell Beydar	Tell Beydar	GDA 1	GDA 2	Syria 1	Syria 2
Clay Sample Points	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
MgO	5,6	4,8	4,36	4,02	5,09				
Al_2O_3	13,7	15	13	7,4	10	16	10	16	7
SiO_2	51	54	49	28,9	42				
CaO	12,8	13	12	30,1	21	5	20	15	32
Fe_2O_3	7,3	8,1	7,38	3,8	5,8				
Cr_2O_3	314	273	235	169	311				

The chemical contents of the clay sources from the Kinet region and the ceramic samples were compared according to the MgO+CaO+Al_2O_3 main elements according to the periods (Figure 5).



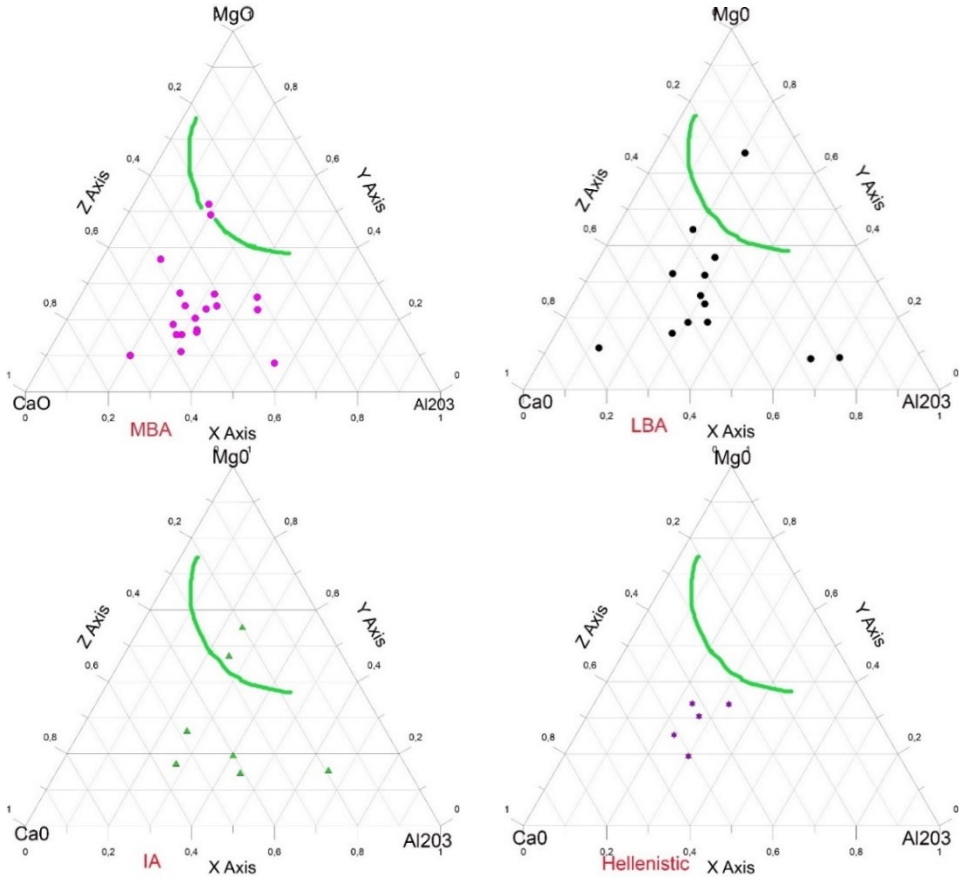


Figure 5. Grouping of clay, EBA, MBA, LBA, IA and Hellenistic period samples, respectively, according to MgO+CaO+Al_2O_3 main element contents based on PED-XRF analysis data (Triangle Plotting).

3.2 Confocal Raman Spectroscopy Analysis

Raman analysis was applied on the KHK-D6 sample taken from the closest point to Kinet Höyük, which has serpentinite as its parent rock, and on the pyroxene minerals in some ceramic samples whose origin rock is serpentinite (Figure 6).

As a result of the analysis, it was determined that pyroxene deteriorated into Antigorite from the serpentine group. It was determined that some of the analysed Kinet pottery samples matched up with the clay of KHK-D6.

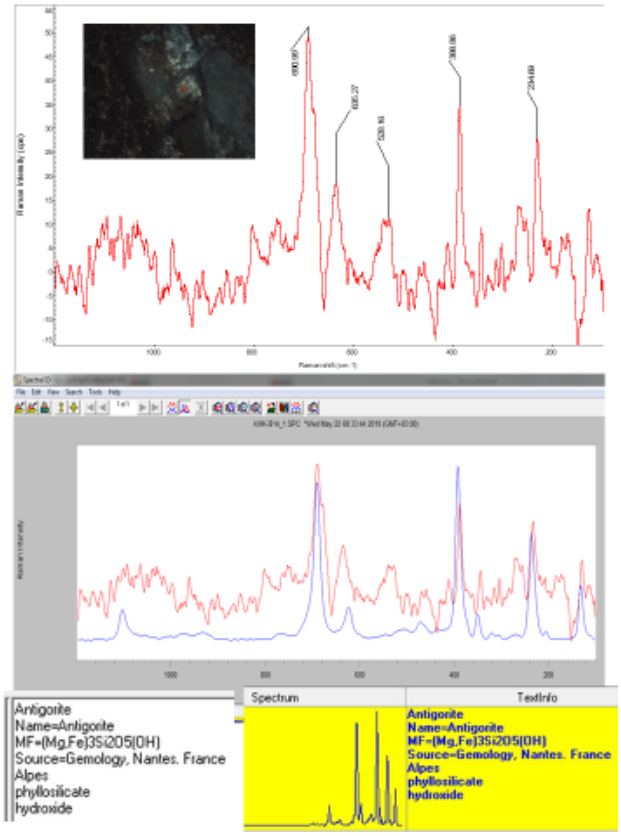


Figure 6. Comparative Raman spectra of ceramic and clay samples (KHK-B14).

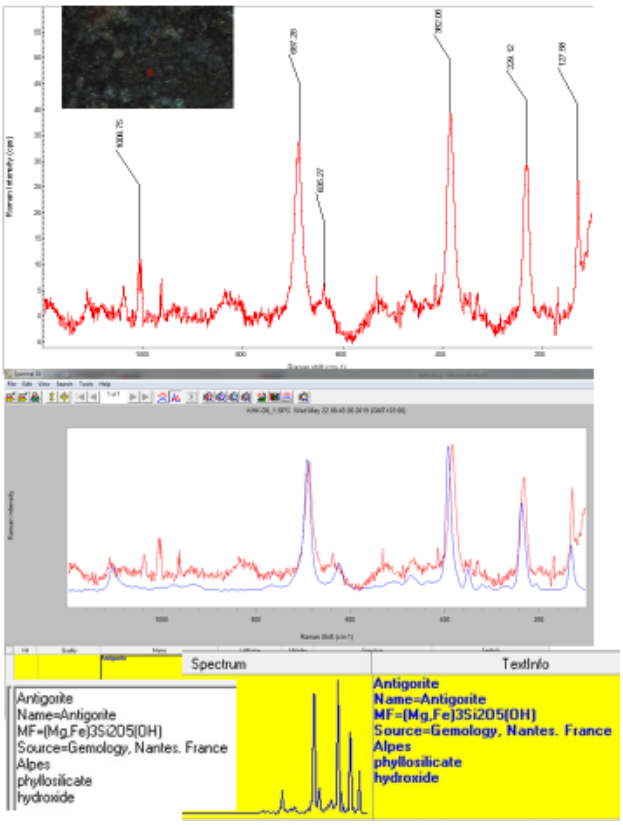


Figure 7. Comparative Raman spectra of ceramic and clay samples (KHK-D6)

3.3. Petrographic analysis

Petrographic analysis of 20 clay samples taken from Kinet Höyük and the surrounding area was carried out. Their locations were compared with the geological formations indicated on the map (Figure 4).

Alongside the Bronze Age samples, earlier Halaf and Ubaid ceramics were analysed to determine the relationships among them. Total sample numbers are as follows: Neolithic/Chalcolithic (20 samples); Early Bronze (78); Middle Bronze (73); Late Bronze (27); Iron Age (20) and Hellenistic (22) (Tables 1-3).

Table 2. The results of the petrographic analysis of the ceramics from different periods found in the Kinet Höyük Excavation, the ceramic clay parent rock, grouping according to their mineral content.

KHK-D5	Quartz, chert, clay, hematite, limonite, basalt rock fragments	KHK-D1	Aşağı Çengen
KHK-D6	Prx, Olv, Plj, L, Serpentinite rock fragments	KHK-D2	Arsuz
KHK-D14	Clay, Q, Ç	KHK-D3	Tarsus
KHK-D7	Phy, Q, serpantinit, listvenit, Ç,Q	KHK-D4	Arsuz
KHK-D8	Sericite, Q, Feldspar	KHK-D5	Çengen
KHK-D12, D13	Sericite, Q, Prx, Plj, Ç, hematite, limonite, ilmenite	KHK-D6	Yeşilköy
KHK-D9	Clay, Q, Ç, Sericite, Prx	KHK-D7	Almanpınarı
KHK-D3	Limonite, calcschist, Clayey limestone, Prx, Q, Ç	KHK-D8	Tepsitepe 1
KHK-D1, D2, D4	Clay, calcite, Q, Prx	KHK-D9	Tepsitepe 2
KHK-D10, D11	Clay, Q, Ç, Prx, Olv, hematite, limonite, ilmenite	KHK-D10	Çengenköy 1
		KHK-D11	Çengenköy 2
		KHK-D12	Deliçay 1
		KHK-D13	Deliçay 2
		KHK-D14	Çengen

Period	Alk. B.	Se	Amf.	Ofik.	And.	B.	G	S	Si	C. Si	Cs	C. L	F.L	Ş	F.
Chalc.		X	X			X		X	X					X	
EBA II	x	x				x		x	x		x	x		x	
EBA III (Early)	x		x			x		x	x						
EBA III (Late)	x		x			x	X	x	x						
MBA I												X			
MBA I/II					X	X				X					X
MBA II					X	X				X	X	X			
LBA l	X	X				X									
LBA ll	X	X		X							X				
LBA lll				X											
IA		X				X				X				X	X
Hellenistic	X					X		X			X		X	X	X

Chalc.: Chalcolite, **EBA:**Early Bronz Age, **MBA:**Middle Bronze Age, **LBA:** Late Bronze Age, **IA:** Iron Age **Alk. B.**: Alkaline Basalt, **B**:Basalt **Se.** Serpentine, **Amf.**: amphibolite, **Ofik.:** Ophicarbonate, **And.**: Andesite **G:** Granite **S.:** Sandstone **Si:** siltstone, **C. Si.** clayey silt stone, **Cs.** clay stone, **C. L.**:Clayey limestone, **F. L:** Fossil Limestone **Ş**: Schist, **Phy:** Phyllite , **Prx,** Pyroxene, **Olv:** Olivine , **Plj**: Plojaclase, **L:** Limestone, **Q**: Quartz

Among the formations in the region, there are ophiolitic, mainly gabbro, basalt, radiolarite and less silicified serpentinites (listevenite) formations. These compositions of ceramic content typically represent the ophiolitic rock group. The ophiolitic rock unit typically represents the oceanic crust and consists of a rock succession called pelagic limestone, basalt pillow lavas, diabase days, gabbro, harzburgite from the top to the bottom (Sarıfakılıoğlu et al., 2017)

Gabbro, basalt, and radiolarite rock fragments were found among the ceramic samples and are associated with ophiolites. Basalts in ophiolite, rocks that come into contact with sea water during their formation form spitic basalt and it is one of the distinguishing features in the determination of ophiolites.

There are metal mineralization (chromite, nickel) mineralization and mineral raw material resources (olivine, magnesite, manganese) associated with basic-ultrabasic rocks belonging to ophiolite formations.

Alkaline basalt is detected in Turkey, in Thrace, in Ezine-Taştepe and Tavşan Island volcanics in Northwest Anatolia, in Kula region from Western Anatolia Volcanites, Afyon volcanics, Niğde Ulukışla-Çamardı volcanics in South Anatolia Region, around Bucak district in Isparta Region volcanics. determined (Türkecan, A., 2015).
It contains alkali basalts within the Ceyhan-Osmaniye-Yumurtalık volcanics in the Amanos region. In addition, it has been determined that the volcanics of Karasu Valley (Hatay) in the Hatay region also contain alkaline basalt. This region is within the Oludeniz Rift Zone. Alkaline basalts were detected under the ophiolites (BaerBassit) in Syria **(Figure 4, 8)** (Türkecan, A., 2015).

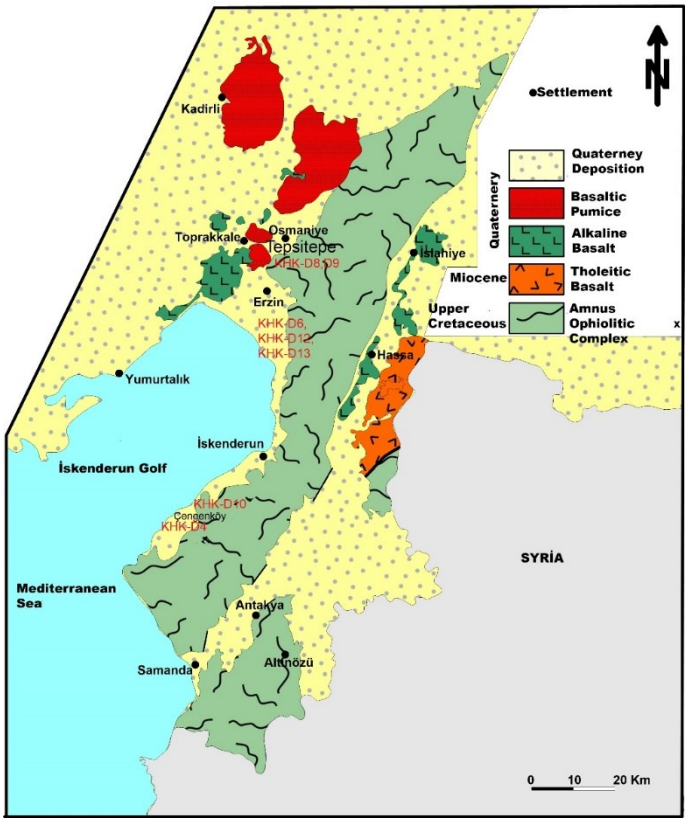


Figure 8. The locations of the clay samples analyzed in the study and the sample points analyzed before and the main geological formations (Kadıoğlu, 2018)

4. CONCLUSIONS

By petrographic analysis, the parent rocks of the ceramics and the rock fragments and minerals in the additives were divided into groups. According to these data, answers were sought for these questions, whether their possible sources were local or brought from outside. In this regard, firstly, the geological formations of the region and the formations related to the production places of the ceramics known to be produced in different regions were determined.

The question of whether the artifact found in archaeological studies was produced in that region, whether it was local or came from outside, is important. The answers to these questions provide the basis for explaining inter-regional relations and intercultural connections. This study also sought answers to these questions and formed a source for future studies.

Some of the Early Bronze Age samples are compatible with pre-Chalcolithic ceramics and suggest continuity. There are petrographic and chemical differences between the Early Bronze Period and the Middle Bronze Period samples of the later period. This must be related to the different communities that came to the region at the end of the Early Bronze Age, and it is important that this situation was also determined by archaeometric analysis.

With the study, the determination of the additives in the pastes of the ceramics, the surrounding clay sources and geological formations, and the ophiolite formation around Kinet Höyül and the contents of the alkaline basalt rocks are clues for the possible sources of the ceramics. It strengthens the idea that ceramics belonging to different periods were produced locally with clay material taken from the close environment according to their parent rocks. Of course, although ophiolite and alkaline basalt formations are known from different regions, it strengthens the possibility that they obtained and exploited the raw material source from the closest place.

Among the ceramics grouped according to their origin rocks, Serpentinite-amphibolite, Ophicarbonate, rocks associated with ophiolite, Alkaline basalt, andesite volcanic rocks are found in the region. The production places of this group of ceramics should be sought in these regions. While alkaline basalts are also known in the Gedikli region east of Amanoslar, the chemical contents of the clay and ceramic samples of this region differ.

According to the results of the chemical analysis, the high values of MgO and Cr_2O_3 (Chromium) in clay and samples due to the formation of ophiolite give an important clue, especially the samples taken from near Tepsitepe and Deliçay have this feature. The high MgO and Cr_2O_3 (Chromium) values in some ceramic samples give information about the production sites.

This study, which aims to determine both the differences in their own periods and the continuity relations in the later periods, in the ceramics recovered from Kinet Höyük in different periods will also form a database for future studies.

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Review

Recent Developments with Biosensors in the Diagnosis of Cancer Diseases

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ABSTRACT:

Aim: Early diagnosis is very important in cancer diseases. Our aim in this study is to reveal the latest developments in the studies on the use of newly developed biosensors in the early diagnosis of cancer diseases.

Material and methods: For this purpose, the results obtained in studies using different methods and materials in different types of cancer were evaluated. The sensitivity and specificity rates obtained with biosensors in the diagnosis of cancer were compared with the results obtained by conventional methods.

Results: According to the results obtained in studies conducted with biosensors, the diagnosis of cancer diseases can be made with biosensors in a cost-effective way, in real-time, with much higher sensitivity, specificity and selectivity than conventional methods.

Conclusion: According to the findings we obtained in our study, biosensors have opened a new era in the diagnosis of cancer. Early diagnosis of all kinds of cancer diseases will be possible with this method and mortality will be decreased to very low levels.

KEYWORDS: Biosensor, early diagnosis, cancer disease.

1. INTRODUCTION

Cancer diseases are the second cause of death in the world [1]. Early diagnosis in cancer diseases is the most important factor reducing mortality rates [2, 3]. Due to the fact that most of the conventional methods used in the diagnosis and screening tests of cancer diseases are not effective in the early period, expensive, and not easily accessible; mortality rates are still high [4, 2]. Especially in studies conducted by scientists, non-invasive molecular marker tests, advanced imaging methods, artificial intelligence-supported advanced diagnosis methods, have rapidly increased the diagnosis rates of early cancer and precancerous lesions and significant decreases have been achieved in mortality rates [1, 4]. Although most of the conventional cancer diagnostic tests available for early diagnosis of cancer diseases are expensive, low sensitivity, require special technical personnel and are time-consuming tests.

Biosensors have many advantages such as high sensitivity and specificity, portable, low cost, effective in many cancer types and real-time. While conventional diagnostic tests can detect the presence of 1 billion malignant cells in tumor tissue with a diameter of only 7-10 nm, optical biosensors can detect several million malignant cells [5, 6, 7]. Especially with the development of microfabrication technology, biocompatibility, field enhancement and 2-dimensional materials that provide higher surface-volume ratios, significant successes have been achieved in the early diagnosis of cancer and some other diseases[5].

Biosensors are devices that analyze and detect signals from biological structures such as DNA-RNA-protein and convert them into electrical or digital signals. New generation 2D biosensors have great flexibility and wide application areas [8].

The most commonly used nano-material-based biosensors for the detection of biomarkers in cancer diseases are: colorometric biosensors convert chemical or biological reactions into color signals.

However, their sensitivity and specificity are relatively low. The sensitivity and specificity of fluorescent biosensors are extremely high. Successful results are obtained in the diagnosis of cancer biomarkers with Surface-enhance Raman scattering-based biosensors designed in recent years. With surface plasmon resonance based biosensors, biomarkers in many cancer types such as PSA, VEGF and BRCA can be detected with great sensitivity.

Electrochemical biosensors are used as effective signal transducers in the diagnosis of cancer biomarkers. In addition, biosensors such as electromagnetic meta-material-based biosensors and Label-free photonic crystal refractive index biosensors used in the diagnosis of cancer biomarkers have been developed in recent years [9].

2. MATERIALS AND METHODS

2.1. Recent Advances In Biosensors In The Diagnosis Of Cancer Disease

In addition to the advantages of biosensors in the early diagnosis of cancer, such as high selectivity and specificity rates, low cost, and rapid results, one of the most important advantages is their high miniaturization features. Especially nanosensors using different nanoparticles are ideal for these applications. In colon and lung cancers, which are among the most common causes of death in the world, early diagnosis will be possible in the very near future, with low cost, in a very short time, with continuous monitoring of body fluids, especially with miniature biosensors using electrochemical methods [10]. Early diagnosis can be made by detecting biomarkers in many cancer types with the highly sensitive and effective paper-based biosensors developed in recent years. The noninvasiveness and low cost of these methods will lead to their more frequent use in cancer screening in the near future [11]. Metal-organic frameworks, which emerge as porous crystal materials, are used as electrochemical-based biosensors in the early diagnosis of cancer by enabling the detection of mRNAs, living cancer cells and biomarkers due to their ultrasensitive properties, as well as areas such as energy and environment [12]. Shariianjazi et al., in their study, showed that nano-material-based nanobiosensors are excellent tools in the early diagnosis of cancer disease at the molecular level, and that newly developed quantum dots, upconversion nanoparticles, inorganics such as ZnO-MoS2 and metal-organic frameworks and it is very effective in the diagnosis of diseases such as lung, colon, prostate and breast cancer was reported [13].

Aptamers are oligonucleic acids that can bind to specific target molecules and are also found in the structure of miRNAs. Due to these features, aptamer-based biosensors have been developed that enable early diagnosis with high sensitivity and selectivity in all cancer types [14]. With newly developed L-tryptophan-based electrochemical potentiometric aptasensors, the sensitivity limit in cancer diagnosis has been increased to 6.4x10-11 M[15]. In a study by Lu et al., it was reported that plasmon-enhanced biosensors are very effective for the analysis of microRNAs, which are very important biomarkers in the early diagnosis of cancer, and the most important reason for this is the hypersensitive properties of plasmons [16].

An ultrasensitive electrochemical biosensor for the detection of MALAT1 lncRNA, which is effective in the diagnosis of non-small cell lung cancers, was developed by Chen et al. A gold nanocage combined with a decorated screen-printed carbon electrode (SPCE) was used. Thus, a ripping new method has emerged in the early diagnosis of cancer with low detection limit (42.8 fM), stable, wide linear range (10-7-10-14 M), excellent biocompatibility and conductivity due to its large surface area [17]. In a study by Syed et al., it is possible to detect circulating tumor cells with high sensitivity in a short time with electrochemical and label-free biosensors in lung and prostate cancers, which are the most common causes of cancer death in men, however it may take time for this advanced cancer diagnosis method to apply clinical practice, as it requires billions of dollars of investment was reported [18]. With the [Fe(CN)6]4-/3-redox system electrochemical biosensor developed by Boriachek et al., it has been shown that it is possible to detect miRNA-21, which is one of the most important molecular markers in the early diagnosis of colon cancers, with a superb sensitivity of 1.0 pM. Graphene is a 1 atom thick carbon structure and is an ideal biosensor material due to its exceptional physicochemical properties. Graphene has high electrical and thermal conductivity, optically transparent, has increased chemical and mechanical strength, and for these reasons, graphene can obtain a very large surface area. Because of these features, when they are used in biosensors for cancer diagnosis; it can be easily designed, micromachines can be made, and high sensitivity, specificity and selectivity can be achieved [20, 21].

In a study by Mostufa et al., .it was reported that early diagnosis can be perform with very high sensitivityTiO2/Au/Graphen-based surface plasmon resonance biosensors in 6 different cancer types (breast (MCF-7 cell), breast (MDA-MB-231cell), skin, leukemia, adrenal gland, cervical) [22].

The specificity of serum PSA measurements, which is the most commonly used biomarker in the diagnosis of prostate cancer, is quite low. Therefore, diagnostic methods with higher sensitivity and specificity are needed for the early diagnosis of prostate cancer, which is one of the most common types of cancer in men. With DNA-linked nanoprobe biosensors developed by Kshirsagar et al., it is possible to detect miRNA-21/miRNA-141/miRNA-375 panel molecular markers, which can provide

correct results in a single step in the early diagnosis of prostate cancer, with high sensitivity and specificity, without the need for PCR tests. and in vitro [23]. Cervical cancer is one of the most common cancer types in women, with a mortality rate of 50%. With a thoroughly computerized method developed by Baabuc et al., it has been shown that the levels of miR-21-5p and miR-20a-5p, whose expression is increased in serum in cervical cancers, can be detected with high sensitivity and specificity with a biosensor [24]. In a study by Uygun et al., it was shown for the first time in the literature that circulating tumor DNA could be detected label-free with high sensitivity and specificity using impedimetric biosensors powered by CRISPR-dCas9 [25].

As seen in the studies we analyzed in our study, biosensors are rapidly taking their place in the medical world, opening a new era in the early diagnosis of cancer diseases.

4. CONCLUSIONS

According to the results we obtained in our study, it will be possible to detect specific molecular markers to be investigated according to the type of cancer disease in all types of cancer in the near future with an extraordinarily high sensitivity, specificity and selectivity with biosensors and it will be possible to detect them at the very early or precancerous stage, and mortality will decrease to minimal levels. However, huge investments are required to offer this new technology into the service of humanity worldwide.

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