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Plastic Waste Management and Circular Economy in Albania: A Mixed Methods Analysis of Challenges and Opportunities

Luiza Lluri*[1] and Faldi Lluri[2]

[1]*Aleksandër Moisiu University, Department of Engineering and Maritime Sciences, Durrës, Albania*
[2]*Aleksandër Moisiu University, Faculty of Information Technology, Durrës, Albania*

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ABSTRACT

This study draws on a mixed-methods research design to assess plastic waste management challenges and circular economy opportunities in Albania. Qualitative stakeholder interviews and quantitative data on waste management practices illustrate the systemic challenges and policy deficiencies that policymakers must address. This research draws from a comprehensive literature review, followed by stakeholder interviews with government officials, municipal authorities, private recyclers, non-governmental organizations, and workers in the informal sector, providing triangulation and validation of findings. Quantitative data were gathered from national and EC databases, concentrating on waste generation, recycling rates, and landfill volumes within the time frame of 2019 to 2024. The findings confirm that Albania's waste management system has serious shortcomings in infrastructure, public engagement, and in the implementation of policies. Only 30% of municipalities in Albania have recycling programs, and national recycling rates are very poor, increasing from 6% in 2019 to 10% in 2024. The mass generation of waste from plastic consumption per capita increased from 18kg to 20kg annually, corroborating the growing consumption trends. Urban centers (such as Tirana) provide a greater percentage of recycling coverage (~50%) as compared to rural regions (<10%). If Albania increases recycling and lowers plastic to the environment this will not only help the country meet EU environmental responsibilities but also support the overall development of sustainable development, green jobs, and climate resilience.

1. INTRODUCTION

Plastic pollution is fast becoming one of the major environmental issues around the world, and Albania is no different. Due to the increasing urbanization, industrialization, and consumerism, Albania faces a problem with rising plastic waste production estimated to be over 120,000 tons annually. Sustainable waste management with effective plastic recycling and minimized environmental impacts is important for developing resources. Albania's European Union (EU) perspective resulted in greater emphasis on harmonizing waste management policies to align with the EU Waste Framework Directive which embodies circular economy principles, establishes waste management priorities that promote preventing and reusing or recycling waste versus land filling.This research seeks to assess how circular economy models may help suggest solutions for addressing plastic waste management challenges in Albania. The circular economy keeps resources in use through the reuse and repairing of materials, recycling, or regenerating them, creating a paradigm shift from the linear economy that operated on a take make dispose model [24]. By adopting circular economy principles in taking responsibility for plastic consumption and disposal, it is likely to help Albania transition to a more sustainable and resource efficient system. This research project looks at the current conditions for recycling plastic in Albania while identifying major challenges for waste management success prior to formulating a circular economy based plan [25]. Building a resilient recycling system entails coordinated policy frameworks and working with stakeholders and community members. This research aims to further discussions on sustainable development, by proposing concrete alternatives relevant to the

*Corresponding author
*e-mail: luizalluri@uamd.edu.al
ORCID ID: 0009-0006-4105-0014

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socio-economic and environmental situations in Albania.

2. BACKGROUND AND CONTEST

Albania is producing roughly 1.2 million tons of waste each year, of which plastic waste is estimated to comprise around 13%. A large volume of plastic waste remains uncollected or disposed of improperly; this is ultimately growing the generation of marine pollution, especially through access to the Adriatic and Ionian Seas. Some municipalities are beginning to introduce waste separation systems at the source, but many of those systems are challenging to implement due to issues of inconsistent implementation logistics and low citizen participation [22].

The 2024 National Strategy for Integrated Waste Management was created with international partners and states ambitious goals such as increasing the overall recycling rate to 25% by 2030 and decreasing the share of waste that goes to land filling through the introduction of alternative waste treatment methods. There are still challenges in terms of enforcement, the coordination among stakeholders, and the availability of sustainable financing mechanisms [19].

2.1. Waste composition in Albania: plastic vs other materials

Albania has serious waste management issues, and plastic waste is a large part of their Municipal Solid Waste (MSW) problem. Data from different sources inform us of the different values of urban waste composition throughout Albania (2024). The table 1 highlights some of the values of waste composition.

Table1. Plastic waste in contrast with other materials in Albania (2024)

Waste material	Approximate % of total MSW	Key notes
Organic waste	45% - 50%	Largest share, mostly food scraps and yard waste.
Plastic waste	13% - 15%	Significant share, mainly single-use plastics.
Paper & Cardboard	8% - 12%	Packaging, newspapers, and office waste.
Glass	5% - 7%	Bottles, jars, and containers.
Metal	3% - 5%	Cans, scrap metal, and small appliances.
Textiles	2% - 3%	Clothing and fabric waste.
Other(wood, rubber, etc.)	5% - 8%	Includes miscellaneous materials.

Clearly, these values suggest that plastic makes up a significant portion of the overall waste in Albania, which emphasizes a need for Albanian authorities to improve waste management strategies, and to increase overall recycling approaches [3]. Figure 1 shows waste composition in Albania plastic vs other waste (2024).

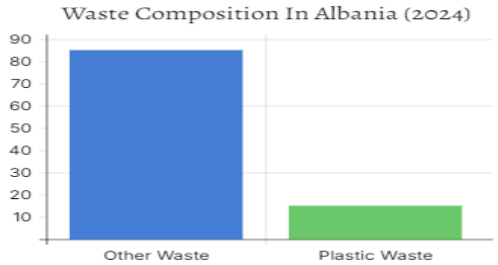

Figure 1 Waste composition in Albania plastic vs other waste

2.2. Circular economy principles

The circular economy is an economic model that seeks to reduce waste while maximizing resource utilization. Implementing the principles of a circular economy in plastic waste management requires changes to the design of plastics, consumptions habits, and disposal methods [6].

In general, this means producing plastics that are durable, recyclable, and less toxic, while promoting responsible consumption and better end of life for plastics (for example, chemical recycling vs. mechanical recycling). The following essential principles of the circular economy can be applied to plastic recycling:

Design out waste and pollution

Product and packaging design should promote less waste, and support recycling processes.

Maintain products and materials in use

The practice of reusing and repairing products allows plastic products to remain in use for longer usability. By reusing and repairing products, products can be redesigned and lessen their usable life until the plastic product is energy or material recovery [10].

Regenerate natural systems

Circular approaches regenerate and repair natural systems, avoiding their destruction.

Create systemic ınnovation and collaboration

Integrating circular economy principles into Albania's national waste management strategies can be a critical starting point to address current waste and recycling issues [6]. With improved product design for recyclability, it is possible to improve the efficiencies of recycling facilities even if they operate at limited capacity. Awareness initiatives indicate that successful reuse, environmental and economic advantage can raise community involvement and behavior change [13]. Figure 2 presents the basic principles of the circular economy.

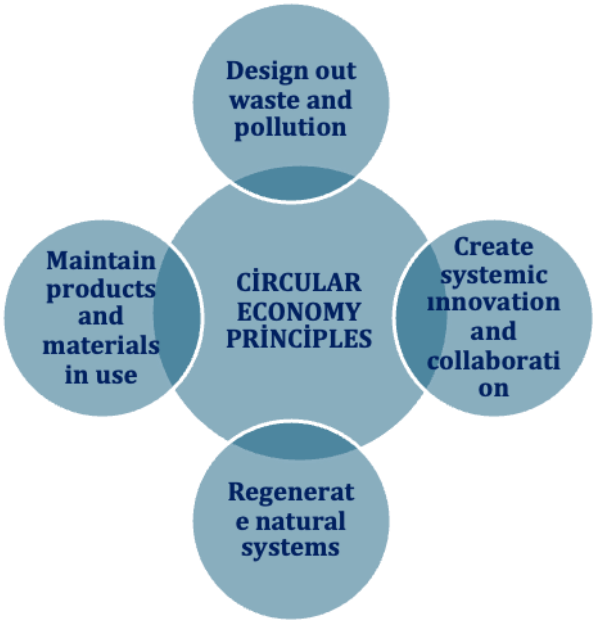

Figure 2 The essential principles of the circular economy

3. MATERIALS AND METHODS

This study employs a mixed-methods research design combining qualitative and quantitative approaches to provide a comprehensive understanding of plastic waste management challenges and circular economy opportunities in Albania. The integration of diverse data sources allows triangulation to enhance the validity and reliability of findings, data collection ,stakeholder ınterviews, waste management data analysis.

An extensive review of academic articles, government reports, policy documents, and international organization publications was conducted to establish the theoretical foundation and contextual background. Sources included scientific databases such as Scopus and Web of Science, official albanian government websites, and EU environmental policy documents.

Key players in Albania's waste management industry participated in semi-structured interviews. Among the participants were representatives from, Ministry of Tourism and Environment, municipal waste management authorities, private waste collection and recycling companies, non-governmental organizations focused on environmental sustainability, ınformal sector workers involved in plastic collection and recycling [23]. Interviews aimed to capture diverse perspectives on existing challenges, policy implementation, public engagement, and potential solutions .

Quantitative data were collected from official sources such as the Albanian Institute of Statistics (INSTAT), Ministry of Environment reports and EU monitoring frameworks. Data sets included annual

waste generation volumes, recycling rates, landfill capacities and waste collection coverage across municipalities.

Interview transcripts were analyzed using thematic content analysis. This involved coding recurring themes related to barriers in plastic waste management, stakeholder roles, policy effectiveness, and community participation.The research adhered to ethical standards by ensuring voluntary participation, informed consent and confidentiality of interviewees .

4. RESULTS

The results reported in this section are drawn from the mixed method including semi-structured interviews, quantitative data, and a review of the literature available. These methods provide an overview of the plastic waste systems in Albania. The interviews included a wide range of stakeholders such as government officials, municipal authorities, private sector recyclers and civil society representatives (e.g. NGOs). There was consensus among stakeholders about the main challenges facing the plastic waste system in Albania.

Some of the most ubiquitous cited challenges across nearly all stakeholder groups included an inadequate recycling infrastructure, and limited collection service coverage and effectiveness. Government representatives pointed out that as of the time of the interviews, only about 30% of municipalities had active recycling programs, and that a large portion of the country is left partially or completely without the basic waste separation mechanisms and then recycling [5].

Geographical representation was ensured in the stakeholder interviews in four major urban geographies: Tiranë (30%), Durrës (25%), Vlorë (25%), and Elbasan (20%), as represented in figure 4 below.

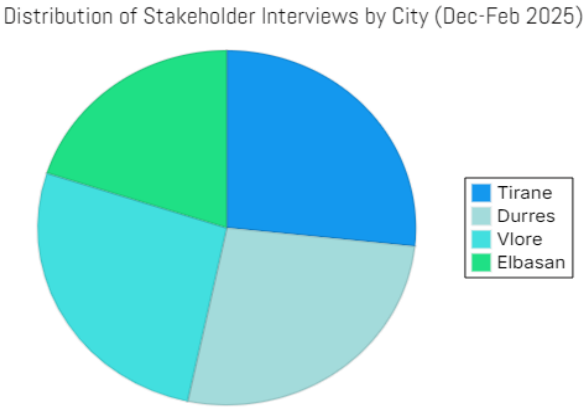

Figure 4. Distribution of stakeholder ınterviews by city

Lack of fully implemented Extended Producer Responsibility (EPR) schemes was widely cited, limiting producer accountability and funding for recycling initiatives. Private sector actors expressed frustration over unclear regulatory incentives and inconsistent enforcement. NGOs and municipal officials emphasized low public participation due to limited environmental education [21]. Many citizens do not separate waste at source, hindering recycling efficiency. Informal waste pickers contribute significantly to plastic collection but operate without legal protections or integration into formal systems, which raises social and health concerns. Analysis of waste management data from 2019 to 2024 showed gradual improvements but still low recycling rates.

The national plastic recycling rate increased from approximately 6% in 2019 to 10% in 2024, reflecting growing efforts but remaining below EU averages.

Plastic waste generation per capita increased slightly, from 18 kg/person/year in 2019 to 20 kg/person/year in 2024, indicating rising consumption patterns.

Regional disparities are pronounced: urban centers such as Tirana report higher recycling coverage (~50%) compared to rural areas, where rates fall below 10%.

Land filling remains the dominant disposal method, with over 70% of plastic waste directed to landfill or illegal dumping sites.

Figure 5 represents the key trends:

- Green bars show the national plastic recycling rate (which grows from 6% in 2019 to 10% in 2024),
- The blue line shows plastic waste generation per capita (rising from 18 to 20 kg/person/year in the same time period).

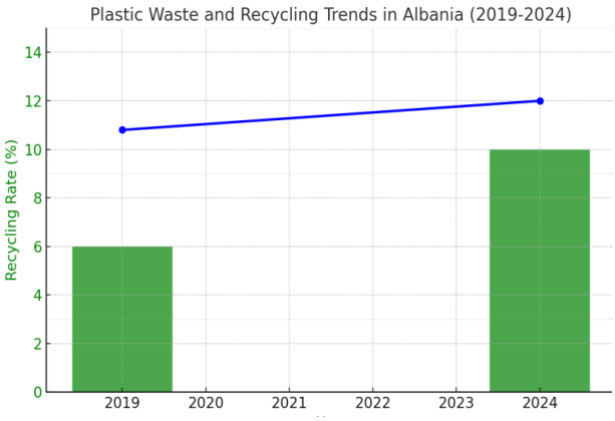

Figure 5. Plastic recycling and plastic waste generation per capita in Albania

4.1. Swot analysis

A SWOT analysis of plastic recycling in Albania includes

Strengths

Rising awareness of environmental issues among youth and non-governmental organizations. The Government's commitment to align environmental standards and policies with those of the EU. Major cities including Tirana have some sort of recycling facilities. The Albanian plastic recycling sector has been supported internationally and continues to be funded through EU institutions and UNDP and the World Bank.

Weaknesses

There are few recycling capacities operate in places outside of major urban centers. Citizen participation is low as they do not have enough knowledge about the recycling systems and practices which are also inconvenient. Weak enforcement of waste management processes and practices. Recyclables that are too contaminated will reduce their quality and ability to be marketed.

Opportunities

Redesigning use of plastic to accommodate the principles of circular economy leads to more opportunities for recycling. Modern sorting and recycling technology must be advanced to improve operational and reduction efficiencies. Public education campaigns create more opportunities for community involvement and participation rate. Changes in legislation create opportunities for regulated waste management systems through positive and negative reinforcements.

Threats

Plastic consumption is increasing faster than recycling capacity can handle. Funding will likely limit infrastructure and technological change. Many industries oppose changes to EPR requirements and their production. Waste management systems and resources have more likelihood of being affected through ongoing impacts of climate change.

5. DISCUSSION

The results revealed a very real disconnect between Albania's policy context and the realities of waste management.

While the legal and strategic infrastructure appears to be closely aligned with European Union norms, the implementing underdeveloped with regard to institutional capacity, coordination and governance structures.

The experiences of Croatia and Slovenia suggest broadly that a collaborative and inclusive strategy, such as Extended Producer Responsibility schemes and citizen engagement forums within their own neighbourhoods, will better support a significant increase in recycling performance [23]. For example, cooperation between municipalities, private recyclers, and civil society will be essential to develop and scale waste initiatives that work. There is also the importance for Albania to develop digital tools to monitor waste flows from a city to end of life and stimulate innovation in the area of recovery technologies for plastics [12].

6. CHALLENGES

Albania faces many challenges in plastic recycling that prevent an efficient and sustainable waste management system from developing. The main challenges include:

Inadequate recycling ınfrastructure

Perhaps the most limiting factor in Albania's waste management sector is its lack of comprehensive recycling infrastructure. Municipalities do not have the capacity to sort, process, and recycle plastic waste, forcing the majority to be designated for landfilling or illegal waste dumping, which increases health risks and environmental damage [17].

Weak regulatory enforcement and policy ımplementation ındeed

Alabnia's legislation is aligned with EU waste policy directives, yet regulations for implementation are often oversaw. The Extended Producer Responsibility framework, is often absent, which means producers do not face consequences for the life cycle of the products they produce. This lack of regulatory framework leads to poorly funded recycling programs as well as fragmented responsibilities [1].

Low public awareness and participation

The lack of public participation and engagement into waste separation and recycling is extremely poor in Albania with little educational outreach and incentive-based collection. Many citizens are not aware of the environmental and economic benefits afforded by recycling, which results poor sorting of recyclable waste at the source of contamination [4].

Integration of ınformal sector

The informal waste sector is an important stakeholder in the collection of plastics, but operates outside established regulatory procedures. Lack of recognition from regulatory authorities limits their access to essential resources, training, and elements of social protections as municipal waste collectors. Furthermore, this complicates the governance of plastic waste streams fundamentally. It is inefficient and unaccountable when there is no perspective from the informal collectors as they operate outside of these institutional structures [2].

Financial constraints and market limitations

Funding restrictions limit investment in advanced recycling technologies and infrastructure improvements. Also, the market for recycled plastics in Albania is still developing, and while there is local and export demand for secondary materials, it remains limited. This sceme creates a financial barrier to short term investment in formalizing a service for a circular economy [10].

Both financial and market constraints present a situation of high risk for stakeholders wanting to formally replicate recycling systems. As a result, informal waste picking and unregulated recycling is still king because it requires little up-front investment and is seen to have more immediate return on investment, even in light of the social and environmental costs [8].

Data gaps and monitoring restrictions

Reliable sources of data on generation, collection, and recycling of plastics is rare and outdated. The absence of reliable and comprehensive data limits evidence based policy development and our ability to monitor our progress. Initiatives to improve the collection of data established in a routine basis for reporting are necessary steps to improve these weaknesses [9]. Figure 5 displays a range of challenges in relation to plastic recycling, that inhibit a waste management approach that is efficient in Albania.

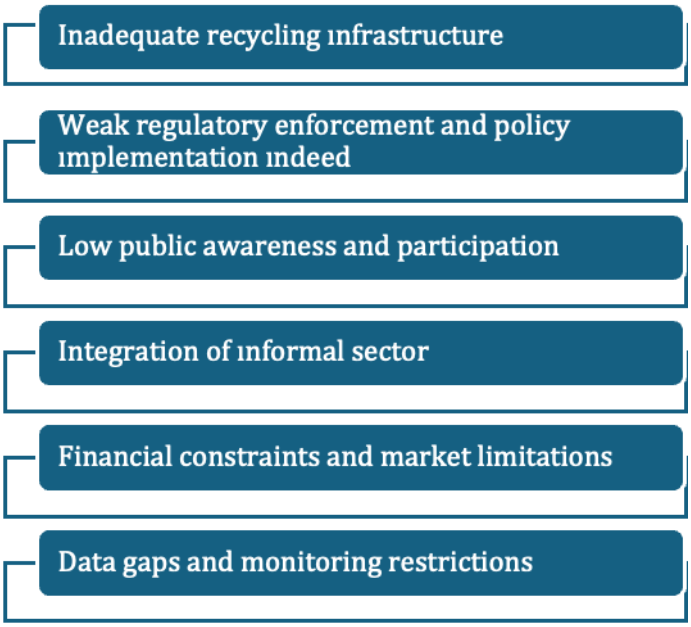

Figure 5. Challenges for plastic recycling in Albania

7. RECOMMENDATIONS

Recommendations related to advancing sustainable development in Albania, specifically around plastic recycling and other sustainability goals are:

Expand recycling infrastructure and services

Modernize and expand recycling facilities to reduce regional disparities, ensure disadvantaged rural and peri-urban areas are a priority when in investing in sorting facilities or refurbishing existing sorting facilities. Improve collection systems creating integrated waste collection services with curbside separation and easy access to drop off locations aimed at increasing recovery rates of recyclable plastics [18].

Enhance regulatory framework and enforcement

Implement Extended Producer Responsibility to establish explicit legal mandates for producer responsibility of the entire lifecycle of products made with plastics, to incentivize design for recyclability, and to create funding for

recycling. Encourage public-private partnerships for giving opportunities for the government, industry, and third party to communicate and collaborate in order to leverage the resource potential of recycling programs, knowledge, and implement scalable recycling programs [7].

Increase public awareness and education

Develop national campaigns use schools, media, and community organizations to raise awareness of the environmental issues caused by plastic pollution and the value of recycling. Promote incentives implementing measures like deposit-return systems or rewards for households and businesses that separate waste consistently [21].

Formalize and ınclude the informal sector

Provide legal recognition of informal workers providing informal waste pickers with formal recognition along with training and social protections to improve working conditions and efficiency. Promote collaboration introduce framework for cooperation between informal collectors and municipal waste services [23].

Develop markets for recycled plastics

Assistance recycled product industrial sectors deepen demand through financing and technical assistance for businesses that use recycled materials. Quality standards established developing protocols to regulate the quality and reliability of recycled plastics and develop market confidence [12]. Recommendations related to promoting sustainable development in Albania, in particular around plastics recycling and other sustainability targets can be seen in figure 6.

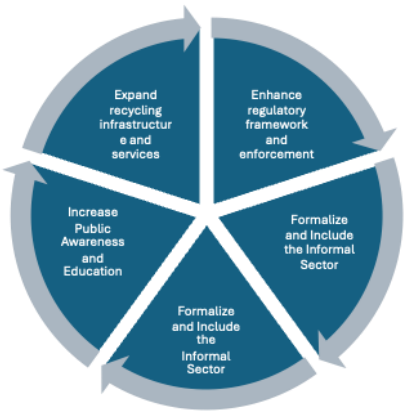

Figure 6. Recommendations to sustainable development in Albania

8. LIMITATION

This study acknowledges a few limitations that ought to be considered:

Data availability and reliability

Detailed information, whether national or necessary in terms of being current and comprehensive, on the production, consumption and recycling of plastics in Albania is extremely limited. This can compromise the completeness and accuracy of the analysis.

Scope restrictions

This study is primarily concerned with plastic wastes, one of several types within Albania's waste management system. This does not address other important waste streams, including organic, electronic, or construction waste.

Barriers to implementation left untested

The study has outlined the advantages of circular economy models, but it has not completed a thorough evaluation of Albania's institutional, legal, and infrastructural capacity for implementing them at scale [14].

9. Conclusion

In order to combat plastic pollution and achieve sustainable waste management in Albania, a comprehensive national plan is needed that engages all stakeholders. This includes formal mechanisms to improve institutional coordination, expand infrastructure, formalize the informal sector, and foster public participation. The challenges and opportunities related to EU integration imply that now is a critical time to improve waste management systems. There is hope that, by investing in innovation, education, and community based initiatives, Albania can embark on a journey to become a more circular economy with the emphasis on environmental sustainability as well as socio-economic development [15]. A successful strategy should also employ a multi-stakeholder approach that effectively engages municipalities, businesses, and fosters public ownership and participation in recycling. We recommend an accountability system, further datasets for environmental improvement, regulatory frameworks related to waste that are enforced with fines, to measure success in the long-run that are transparent.

Regional cooperation with other Western Balkan countries can also promote efficiency and synergies through shared best practices and

economies of scale, in the transition to a more sustainable environment and to tackling the challenges associated with plastic waste and pollution. In summary, creating a commitment to tackling plastic waste in Albania is the first step to improving public health, biodiversity and creating economic opportunities for Albania, fostering the principles of a green economy and advancing along the path of EU integration [20]. Advancement with recycling technology development, improved waste service collection, and strong policy development, including Extended Producer Responsibility (EPR) and continued public awareness, are critical for success. National and international collaboration and support will also help accelerate success.

Transitioning to a circular plastic economy will support Albania's sustainable development agenda because it advances environmental health and economic development and with it enhances social welfare. Moving towards a circular plastic economy will reduce pollution, protect natural resources, and reduce greenhouse gas emissions, which will all contribute towards environmental sustainability and achieving Albania's climate targets [16].

This research outlines the critical need for a more integrated and holistic approach that includes improving recycling initiatives and infrastructure, improving public awareness and policy mechanisms such as Extended Producer Responsibility (EPR) and once the system is formalized in the context of the transition a private public partnership will support better system innovation and efficient use of resources.

10. FUTURE RESEARCH

Future research should focus on longitudinal effects of policy changes and quantification of environmental impacts of better recycling in terms of environmental benefits. Further, exploring changes in consumer behavior (e.g. what consumers have retained from education campaigns) when evaluating effective interventions would prove insightful.

Future research should include, in the form of household and industry surveys or interviews, primary data collection to measure waste generation, waste segregation behaviors, and recycling behaviors in Albania. Implementation and evaluation of pilot projects in selected municipalities would help provide information on the practical challenges and enablers on the ground as they relate to opportunities for circular economy adaptation in that area, especially for rural or marginalized communities.

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Conflict of Interest

No conflict of interest is declared by tehe authors. In addition, no financial support was received.

Ethics Committee

The study protocol was approved by the Ethics Committee of the Institute of Health Sciences of Bandırma Onyedi Eylul University (Ethics Committee Approval: 2022/170).

Author Contributions

Study Design, L.LL; Data Collection, L.LL,F.LL; Statistical Analysis, L.LL; Data Interpretation, F.LL; Manuscript Preparation, F.LL; Literature Search, F.LL. All authors have read and agreed to the published version of the manuscript.

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