TO The Chairperson of the Scientific Jury

in accordance with the Faculty Council Protocol No. N 60 / 14.02.2022 1and Order No. R 109-88 / 23.02.2022 of the Rector of the Medical University - Varna 2

REVIEW

Regarding: the awarding of the educational and scientific degree of **"Doctor/PhD"** to Dr. **Magdalena Ivanova – Bosheva, MD**, in accordance with the decision by protocol No. 46 / from 29.09.2025 of the Faculty Council and Order No. P-109 - 402/1.10.2025 of the Rector of the Medical University of Varna, based on Art. 24, para. 6 and Art. 30, para. 3 of the Regulations on the Development of Academic Staff in the Republic of Bulgaria (PPZRASRB), Art. 68, para. 1 of the Regulations for the Development of Academic Staff at the Medical University – Varna.

Topic: "Motor activity in hemodialysis patients and possibilities for its optimization"

Biographical Data and Career Development

Dr. Magdalena Bosheva graduated from the Medical University - Varna, Faculty of Medicine. In 2020, after winning a competition, she was appointed as a resident physician and assistant at the Clinic of **Physical and Rehabilitation Medicine (PRM)** at "St. Marina" University Hospital - Varna. Since 2023, she has held a master's degree in **"Health Management and Medico-Social Care"**. To date, she works at the PRM Clinic and is a lecturer at the Department of **"General Medicine"** at Medical University - Varna. Additional areas of scientific research include **nephrology, dialysis, intradialytic exercises, kinesiotherapy, kinesiology, and sleep medicine**.

Relevance of the Developed Topic

Chronic Kidney Disease (CKD) represents a global health problem associated with reduced life expectancy. In patients undergoing **hemodialysis (HD)**, survival is **75% lower** compared to the general population. A significantly reduced physical functional capacity is observed—about **70%** of that of clinically healthy individuals—but after starting HD, the values drop to approximately **50%**. Hemodialysis patients suffer from a high degree of **disability**, resulting from the complications of CKD and a sedentary lifestyle, which further limits their ability to perform daily activities.

For years, insufficient attention has been paid to the **rehabilitation** of these patients. Rehabilitation represents a coordinated, multi-faceted intervention designed to optimize the patient's physical, psychological, and social functioning. **Renal rehabilitation** is an effective,

feasible, and safe strategy for secondary prevention. The new rehabilitation concept is to "add life to years and years to the life" of patients with Chronic Renal Failure (CRF).

Literature Awareness

Their **physical activity** is of paramount importance for patients in various stages of CKD. A suitable methodology for positively influencing the low motor activity in patients with **End-Stage Kidney Disease (ESKD)** is the introduction of **intradialytic exercises** in hospital settings using a specially mounted bedside bicycle. Intradialytic exercises demonstrate great activity on the part of the patients.

The doctoral candidate has prepared a precise and detailed review presenting key literary data related to aerobic exercises with a specially mounted bicycle, which **improves blood circulation, muscle tone, and physical endurance, and reduces fatigue and muscle spasms (cramps)** that appear at the end of the dialysis procedure. This contributes to the **prevention of muscle mass loss and malnutrition**, thereby improving the **quality of life** of HD patients.

Aims and Objectives

The **main goal** of the dissertation is precise and specific: the application of **cardio-bicycle exercises** to improve bone-mineral status, objectified through Ca/P exchange indicators. **Five objectives**, executed chronologically, were established to fulfill the goal.

Evaluation of Material and Methods

The selection of subjects was made from patients with CKD who underwent treatment during 2023-2024 at the dialysis center at "St. Marina" University Hospital - Varna. **Eighty-one patients** (47 men and 34 women with ESKD) were included. Participants were randomized on a random basis. The **working group** included 42 patients, and the **control group** included 39 patients. The device used for the purposes of this study is a **specialized bicycle**.

Statistical analysis was conducted using: **descriptive analysis, variance analysis, and alternative analysis. Parametric and non-parametric methods** were applied to test hypotheses. All statistical tests were two-sided.

Evaluation of Results and Discussion

A significant part of the author's work is dedicated to a detailed study of:

- The influence of HD treatment on **motor activity and individual quality of life** through an adapted version of the standardized Kidney Disease Quality of Life-Short Form (**KDQOL-SF**) questionnaire.
- The evaluation of the influence of specialized **cardio-bicycle exercises** on the **clinical status** of chronic dialysis patients, objectified through:
    - **Laboratory indicators for bone-mineral disorders.**
    - A **6-minute walk test (6MWT)**—a clinical assessment of gait disorders and static/dynamic balance.
    - Prophylaxis of complications of the underlying disease.
- The application of a specialized questionnaire to establish the main reasons for the **deterioration of patients' motor activity** and the stratification of risk factors.

The **discussion** is presented accessibly, consistent with the obtained results, and compared with studies on the topic in the current foreign literature.

A **systematic improvement in clinical symptoms** was found for the experimental group:

- The proportion of patients who **did not feel muscle pain** increased from **19% to 33%** ($p = 0.02$). The control group showed no such statistically significant difference.
- In the experimental group, the proportion of patients who **limited their professional work and other activities** decreased significantly from **78.6% to 71.4%** ($p = 0.046$). In the control group, this proportion remained unchanged ($p = 0.223$).

The difference between the control and experimental groups was striking when answering the question, **"Did you feel happy?"**. In the control group, the proportion of those who answered positively was 1/3, while in the experimental group, this proportion **increased from 54.8% to 76.2%** ($p = 0.002$).

CKD-MBD (Chronic Kidney Disease-Mineral and Bone Disorder) is a predisposing factor for increased cardiovascular risk. A significant portion of patients with high values of **iPTH, Ca and P** shared that HD and its complications affect their perception of general health ($p = 0.003$). The highest **Health-Related Quality of Life (HRQoL)** is reported in patients with a PTH concentration of **150 to 300 pg/ml, 2.10 - 2.55 mmol/l,** and a serum phosphorus concentration of **<1.2mmol/l**. HD most often has a moderate effect on the patients' physical activity, as well as their perception of general health.

Creating an **original algorithm** for performing intradialytic exercises and implementing it into routine clinical practice is necessary for the prophylaxis of complications of the underlying disease. Planned physical exercises, including **aerobic and resistance training**, are well-known in the scientific literature as a therapeutic intervention that has been proven to relieve some of the complaints accompanying their treatment, improve physical fitness and health, reduce mental stress, and **improve Quality of Life (QoL)**. A modified version of the **KDQOL-SF** questionnaire, validated in Bulgarian, was used for research and evaluation, allowing for easy interpretation and the calculation of two summary measures for physical and mental health.

Based on the results obtained, **key conclusions** were drawn that are correctly formulated, follow the data from the results, and correspond to the set goal and objectives.

Scientific Contributions

The scientific contributions are as follows:

1. It is established that **bone-mineral disorders** significantly affect the patients' physical activity, emotional and mental stability, and the perception of improved condition.
2. Patients on HD have a significant **impairment in their functional status**, which necessitates the application of **aerobic intradialytic exercises**.
3. An **original algorithm** has been created for performing intradialytic exercises and its implementation into routine clinical practice for the prophylaxis of complications of the underlying disease, improved disease management, rehabilitation, and **quality of life for ESKD patients**.
4. The role of performing **intradialytic aerobic exercises** in chronic dialysis patients, as well as their influence on the patients' **emotional status and self-esteem**, has been evaluated.
5. **Aerobic intradialytic exercises** with a specialized bicycle have been applied to chronic dialysis patients.
6. An **algorithm for conduct**, including laboratory and functional tests for patients with CKD-MBD, has been developed.

Conclusion

Dr. Bosheva's dissertation and the accompanying abstract are characterized by **thoroughness and consistency** in examining the problem.

Scientometric Criteria

The doctoral candidate provides a list of **4 publications** related to the dissertation, in **three** of which she is the first author. The attached list fully meets the requirements for obtaining the educational and scientific degree of "Doctor/PhD" at the Medical University - Varna. The abstract is well-structured, accurately illustrated, and reflects the essence of the dissertation.

In conclusion, I determine that Dr. Magdalena Bosheva's dissertation is a **relevant and significant scientific work with great practical importance**. The dissertation presented for an opinion contains **original contributions of an applied nature** which are the author's own work.

Based on the above, I am confidently proposing to the members of the Scientific Jury to **vote positively for the awarding of the educational and scientific degree of "Doctor/PhD" to Magdalena Bosheva,** MD.

Respectfully,

Prof. Emil Paska