UNIVERSITY OF BELGRADE
FACULTY OF SPORTS AND PHYSICAL EDUCATION
Beelgrade, 8.9.2025. god.

TO THE TEACHING AND SCIENTIFIC COUNCIL OF THE FACULTY

Subject: Report of the Committee for Review, Evaluation and Defense of the Doctoral Dissertation of Zahi Andraos

The teaching scientific council of the University of Belgrade - Faculty of Sports and Physical Education at the **13th session** held on July 3, 2025. in accordance with Article 40 of the Rulebook on Doctoral Studies - revised text (02-No. 532/22-4 dated November 9, 2022) and Article 41-43 of the Statute of the University of Belgrade - Faculty of Sports and Physical Education - revised text (02-No. 151/24-8 dated December 19, 2024), on the proposal of the Council of Doctoral Studies (02-No. 275/25-12 of June 26, 2025), passed the **Decision** (02-No. 275/25-13) on the formation of the Commission for the review, assessment and defense of the doctoral dissertation of the doctoral academic student Zahi Andraos, entitled "SENSITIVITY OF DIFFERENT HAND GRIP ALGORITHMS IN CLASSIFICATION OF BODY COMPOSITION STATUS RELATED TO HEALTH AMONG LEBANESE ADULTS"

The commission:

1. Dr. **Vladimir Ilić,** full professor, University of Belgrade - Faculty of Sports and Physical Education, chairman of the commission
2. Dr. **Dragan Mirkov**, full professor, University of Belgrade - Faculty of Sports and Physical Education, member
3. Dr. **Miloš Maksimović**, full professor, University of Belgrade - Faculty of Medicine, member.

After reviewing the final version of the doctoral dissertation, the candidate's biography and the list of published works, the Commission submits the following report to the Teaching and Scientific Council of the Faculty:

REPORT

Biographical data:

Zahi Andraos was born on October 27, 1986. in Beirut, Lebanon. He completed his basic studies in the field of physical education in the period from 2005 to 2009 at the Lebanese University of Tahwita, and in 2010 he completed his specialization in physical training at La Sagesse University

in Beirut. In the period 2011 - 2012, he graduated from the Antonine Baadba University in Beirut, majoring in physical training. In 2014, he completed an MBA in banking and finance at La Sagesse University in Beirut, and in the period 2016-2017, he completed his master's studies at the University of Grenoble, France (in collaboration with the University of Lebanon) on the Economic Strategy in Sports and Tourism program. In 2019, he enrolled in the doctoral program of the Faculty of Sports and Physical Education of the University of Belgrade entitled - Research methods in human locomotion, as the best ranked foreign student.

Since 2005, he has been actively playing volleyball in various Lebanese clubs that compete in the first and second leagues of Lebanon. In 2007, he started working as a volleyball coach, first in high school clubs, and in 2014 he started working as a volleyball coach at Antonine Baadba University, at the Faculty of Sports Sciences. In 2018, he worked as a coach in the Volleyball Federation of Lebanon, but also as an external professional associate in the Volleyball Federation of Asia.

Since 2017, he has been working as a professor at Antonine Baadabda University, as well as at Zahle University, where he teaches various subjects and holds various courses in the following subjects: Introduction to sports training, Ethics and history of sports, Basic statistics, Volleyball training methodology, for first, second and third year students of the Faculty of Sports Sciences. In 2018, he was elected to the position of vice-dean at Antonine University Zahle, at the Faculty of Sports Sciences. Since 2021, he has been in the position of head of the Sports Training study program, which is implemented at the Faculty of Sports Sciences Antonine University in Beirut, Lebanon.

The candidate speaks, reads and writes in Arabic, French and English.

Published scientific research works:

The candidate published six (6) scientific research papers, namely two in the M23 category, one in the Q2 category, one in the Q4 category, and two in the M51 category.

1. **Andraos, Z.** (2025). Initial study on Hand Grip Asymmetry in Lebanese Adults: An Advanced Model Integrating Maximal and Explosive Strength. *Studia Sportiva*, 19(2):16-27. https://doi.org/ 10.5817/StS2025-2-2 (Q4)
2. Richa, C., **Andraos, Z.**, El Mdawar, M., Khoury, G. & Dopsaj, M. (2024). Sensitivity Between BMI and IBC as Screening Tools for Overall Health and Nutritional Status: Insights from Hand Grip Strength Analysis Among Lebanese Adults. *International Journal of Morphology*, 42(6):1686-1693 (M23)
3. **Andraos, Z.**, Myriam, D., & Dopsaj, M. (2024). Body Typology of Lebanese Adults: Initial Cluster Cross-Selection Study. *International Journal of Morphology*, 42(3):561-566 (M23)
4. **Andraos, Z.**, & Abi Abdallah, M. (2024). Development of a fitness index score: A normative framework for assessing health-related fitness in Lebanese adolescents. *MOJ Biology and Medicine*, 9(4), 117–123. (M51)
5. **Andraos, Z.**, & El Mdawar, M. (2024). Initial study on normative data for hand grip strength and explosive strength in Lebanese population. *Sportlogia*, 20(2), 47–55. (M51)
6. Dopsaj, M., **Andraos, Z.**, Charbel, R., Abou, M., Maksissi, E., El Zoghbi, A., Dandachi, R., Erlikh, V.V., Cherepov, E.A., Masiulis, N., Nenasheva, A., Zouziene, I.J., Markovic, S., Fayyad, F. (2022). Maximal and explosive strength normative data for handgrip test according to gender: International standardization approach. *Human Movement*, 23(4): 77-87 (Q2)

In his previous scientific work, Zahi Andraos achieved scientific competence at the level of: (2 x 5) + (2 x 4) + (2 x 1) = 10 + 8 + 2 = 20 scientific points. In relation to the index of scientific influence, the candidate has scientific production at the level of - WoS IF = 2 x 0.5 = 1.0 index points of international scientific influence.

In the area of the topic of the doctoral dissertation, candidate Zai Andraos published the following works that are directly related to the subject of the dissertation research:

1. **Andraos, Z.**, Myriam, D., & Dopsaj, M. (2024). Body Typology of Lebanese Adults: Initial Cluster Cross-Selection Study. *International Journal of Morphology*, 42(3):561-566 (M23).
2. **Andraos, Z.**, & El Mdawar, M. (2024). Initial study on normative data for hand grip strength and explosive strength in Lebanese population. *Sportlogia*, 20(2), 47–55.
3. **Andraos, Z.**, & Abi Abdallah, M. (2024). Development of a fitness index score: A normative framework for assessing health-related fitness in Lebanese adolescents. *MOJ Biology and Medicine*, 9(4), 117–123. (M51)
4. Richa, C., **Andraos, Z.**, El Mdawar, M., Khoury, G. & Dopsaj, M. (2024). Sensitivity Between BMI and IBC as Screening Tools for Overall Health and Nutritional Status: Insights from Hand Grip Strength Analysis Among Lebanese Adults. *International Journal of Morphology*, 42(6):1686-1693 (M23)

CONTENTS OF THE DOCTORAL DISSERTATION

Zahi Andraos submitted the final version of his doctoral dissertation: "SENSITIVITY OF DIFFERENT HAND GRIP ALGORITHMS IN CLASSIFICATION OF BODY COMPOSITION STATUS RELATED TO HEALTH AMONG LEBANESE ADULTS", with the following content:

INTRODUCTION

In the Introduction chapter, the author defines the basic terms of the research from a theoretical perspective, and explains the concept of health with a brief explanation of its indicators. Below is the positioning of the "Hand Grip" test as a criterion test of this dissertation, where, first of all, the test itself is positioned in relation to the actual frequency of its use in the research system in the natural and medical sciences, for which the candidate performed an analysis of the structure of publications using the PubMed database for several previous decades (7433 articles per keyword - Hand Grip test).

THEORETICAL FRAMEWORK AND DEFINITIONS

Within the theoretical framework and definitions chapter, the author explains all the necessary and relevant facts related to the issue of body composition research, then with diseases associated with different states of health, and the pathology of body composition (obesity pathology), then the criterion test of the dissertation - the "handshake" test, explains in the concept of terms and

definitions, explains in the concept of social interactions, in the evolutionary concept, as well as in the concept of informative predictor of health indicators. Then, the candidate analyzes previous knowledge regarding the relationship between test results and body composition, analyzes previous knowledge of test results in relation to the performance of athletes, defines variables in terms of key information that can be measured by the test, and from a methodological aspect defines key parameters that can influence the metrology of measuring and applying the results of a given test.

In the following sub-chapters, the candidate provides an explanation of the need to define standards and norms, as well as general and specific models in terms of decision-making procedures for the purposes of classifying and diagnosing the state of nutrition, the level of physical preparedness and the consequent risk to health. In the next sub-chapter, the author discusses and elaborates the problem of defining general (comprehensive) prediction models of health, risk of injuries as well as the effects of physical activity and exercise in terms of health and sports context. Emphasizes the need for the importance of permanent updating of the prediction of health models and points out that the fields of exercise science and health science must have common research priorities, especially due to the growing pandemic of non-communicable diseases such as obesity, the increase in the prevalence of oncological diseases and the constant decrease in the level of physical abilities among young people.

PROBLEM, PURPOSE, OBJECTIVE, TASK and IMPORTANCE OF THE STUDY

In the chapter Problem, purpose, objective, tasks and importance of the research, the candidate emphasizes the reasons for the same and defines all the necessary methodological elements of the scientific basis of the dissertation.

In relation to the dissertation research **problem**, the candidate emphasized that the current evaluation methods for measuring strength, and methods for assessing good health well-being are very complex for cheap, easy and effective application in terms of the general population, and especially in Lebanon considering the demographic and financial situation in the country, but also in relation to the ethnic specificity of the country. Therefore, it is necessary to establish a system that can reliably and efficiently predict the potential risk to health, the risk of injury, but also to provide an assessment of the overall holistic effect of the well-being of life that is adapted to the needs of the specific lifestyle of the Lebanese population.

As the **purpose** of the study, the candidate emphasizes the need to develop a nationally specific and optimized model based on algorithms that assess the nutritional adequacy of body status as well as health risks in relation to indicators of the level of general physical fitness, which should be specific in relation to gender and defined for the Lebanese population.

As research **objectives**, the candidate set the following:

- to develop and define the statistical significance of algorithms based on the parameters of the "handshake" test and as a function of nutritional status (nutritional status, i.e. body composition) and various health risks.

- to create specific predictive algorithms sensitive to gender and health risk, which can be applied sensitively, i.e. for the needs of individual diagnostics (regression analysis and algorithmic scoring system).

- it is planned to define 12 algorithms, 6 of which are specifically adapted for each gender. Then, the sensitivity of the algorithms to individual criterion variables of body composition in relation to different metrics of the nutritional status of the body will be identified.

- in this way, it will be possible to determine the best algorithm for assessing the individual risk of a health condition and identifying those individuals who are at probable risk of diseases related to physical status.

In the research **task** and the **importance** of the research, the candidate has precisely and systematically described all the planned procedures and explained the importance of the expected results that led to the given suggested topic.

Hypotheses

Based on the immediate findings obtained from the analysis of previously published research, as well as other available literature, and based on the defined problem, purpose, goal and tasks of the dissertation, the candidate defined the following hypotheses:

The general hypothesis is –

HG – Algorithms developed using hand grip parameters can accurately predict body composition status related to health with a statisticaly significant reliability and validity considering the gender at Lebanese adults.

The supporting hypotheses are defined as follow:

H 1– The predictive formula derived from regression analysis of hand grip parameters will be effective in future assessments for assessing strength, explosiveness and power for individual.
H 2 –There will be a significant difference in the sensitivity of the algorithms based on gender, with some algorithms being more accurate for males and others for females.
H 3 – The most sensitive algorithm, identified through correlation with body composition variables, will be able to accurately assess the health status and predict the risk of diseases related to body composition.
H 4 –The correlation between hand grip strength scores and body composition metrics will be strong enough to use these algorithms as a reliable tool in clinical and fitness settings for health risk assessments.

Research methods

For the purposes of the realization of this dissertation, transversal research, i.e. a **cross-sectional study**, was used as a non-experimental research, while laboratory testing was used as a measurement method.

The study included healthy adults of both sexes from Lebanon, aged 19 to 68 years. The criteria for inclusion in the research required the absence of hormonal disorders or injuries that could interfere with the performance of the test. The sample of respondents included individuals with varying levels of physical activity, including athletes, active individuals, and sedentary individuals.

The research was conducted on a **sample** of over 395 respondents, proportionally distributed in relation to gender (about 242 men and 153 women). Geographical diversity was ensured by recruiting participants from different regions within Lebanon, with a predominantly Lebanese background. The upper age threshold was 68 to match the typical retirement age in Lebanon.

This heterogeneous and comprehensive sample aimed to provide a comprehensive insight into the population of Lebanon, and in relation to the measurement characteristics of the "handshake" test, as well as to define adequate quantitative relationships with health indicators in different segments of the Lebanese population. The research was carried out in accordance with the standards of the Declaration of Helsinki and with the permission of the Ethics Committee of the Faculty of Sports and Physical Education of the University of Belgrade (02 no. 484-2).

Data collection and testing procedures

The candidate described in detail the procedures and techniques for collecting the necessary data (questionnaire), as well as the methods of measuring body composition (multichannel bioimpedance, device i30, Mediana, Korea) and the method of applying the "handshake" test (standardized and scientifically validated procedures, using the device Sports Medical Solution, All4gym d.o.o., Serbia). The data sampling procedure (questionnaire), as well as all measurements and tests were carried out by certified professional staff, as well as by the candidate himself, at the L3S Laboratory, Antonine University, Baadba, Lebanon.

Variables

For the purposes of obtaining data on the characteristics of the respondents, both for descriptive reasons and for the purposes of cofactors, the candidate used eight (8) variables, namely: origin, gender, chronological age, profession, social status, geographical position of residence in Lebanon, number of training sessions during the week, and duration of an individual session.

Twelve (12) variables were used to define body structure space, namely: BM - body mass, BH - body height, BMI - body mass index, FFM - fat-free body mass, BFM - body fat mass, SMM - skeletal muscle mass, %SMM - skeletal muscle mass percentage, PBF - body fat mass percentage, FMI - body fat mass index, MFI - muscle-fat index, VFA - visceral fat area, as well as IBC - body composition index.

A set of 15 variables will be used to define the contractile characteristics obtained by the "hand grip" test as a potential of the general level of physical abilities, namely: Absolute and relative values - Dominant hand, DHG_F_{max} and DHG_F_{rel}, maximum and relative strength of the hand grip, DHG_RFD_{max} and DHG_RFD_{rel} - maximum and relative explosive strength of the hand grip; Non-dominant hand, NDHG_F_{max} and NDHG_F_{rel}, maximum and relative hand grip strength, NDHG_RFD_{max} and NDHG_RFD_{rel} – maximum and relative explosive hand grip strength; Summary indicators, F_{max}_SUM and F_{rel}_SUM, the sum of the maximum and relative strength values of the dominant and non-dominant hand, RFD_{max}_SUM and RFD_{rel}_SUM, the sum of the maximum and relative values of the explosive strength of the dominant and non-dominant hand, IS_SUM, DHG_IS and NDHG_IS - the sum of the indices as well as the individual values of the synergy index of the dominant and non-dominant hand.

Statistical procedures

In the first step of the statistical analysis, the candidate analyzed all the raw results using basic descriptive statistics, where he calculated all the necessary measures of central tendency and measures of data dispersion (Mean - mean value of the variables; SD - standard deviation; cV - coefficient of variation; MIN and MAX - minimum and maximum value of the variable).

Also, he calculated confidence intervals, i.e. 95% confidence intervals for the mean value, where he thus calculated the lower and upper reference values for assessing the precision of the measurement of all variables.

Multivariate (MANOVA) and univariate (ANOVA) analyzes were used to determine differences between pairs of variables in relation to gender. Correlation analysis, as well as Regression analysis (linear and multiple) was used to calculate similarity links between analyzed variables, as well as for the needs of modeling specific predictive algorithms (predictive formulas) for all observed parameters related to body structure and HG parameters as a function of defined risk scores per animal. Using factor analysis, the research space was optimized, and key variables (parameters) were defined as the main carriers of variance in relation to body composition and handshake characteristics (HG). Finally, the ROC curve was used to calculate the threshold values of the key variables in terms of making criterion decisions (optimal criteria of clinical sensitivity and specificity of variable values).

All statistical analyzes were performed using the SPSS 26.0 and Excel 2016 software packages, thus ensuring accurate and efficient data processing..

The commission agrees that the proposed procedure of statistical data processing, with the proposed statistical analyzes is adequate to the subject, goal and task of the dissertation project, as well as in a logical connection with the defined hypotheses, and agrees with its application and all the results obtained.

RESULTS

The candidate presented in a clear and appropriate manner all the descriptive results of the studies (Tables 15 and 16), then all the results of the discriminative analysis with established ANOVA differences (men Tables 17 and 18, women Tables 19 and 20). The results of the factor analysis, which was used to define the criterion variable, i.e. Fitness Health Risk Score (FHRS_Index) are shown for both men and women in Tables 21 to 24. The results of the discriminant analysis are shown in Tables 25 to 30 for men, i.e. in Tables 37 to 39 for women, while the results of MRA and defined algorithms are shown in Tables 31 to 36 for men, i.e. in Tables 40 to 43 for women. Defined percentile standards in relation to gender are shown in Table 46, while all the results of ROC analyzes are shown in full and systematic precision in Tables 47 to 70, as well as in Graphs 9 to 32.

What are the most important and essential results of the dissertation are defined algorithms for evaluating the Fitness Health Risk Score (FHRS_Index), which are specific to the population of men and women in Lebanon and have the following forms:

For the men of Lebanon –

- Based on the obtained results of multiple regression analysis (MRA), it can be argued that the prediction algorithm for the classification of health and fitness related score (FHRS_index), as a measure for assessing hand grip and health-related body composition status in Lebanese adult men, has the following equation:

$$\text{FHRS\_Index\_MALES} = -52.70537 + (\text{RFD}_{max}\text{\_SUM} \cdot 0.00632) - (\text{BMI} \cdot 0.49435) + (\text{IS\_SUM} \cdot 7.82413) + (\text{Dominant\_F}_{rel} \cdot 5.30915)$$

- Based on the obtained results of the multiple regression analysis (MRA), it can be argued that the prediction algorithm for the classification of health and fitness-related score (FHRS_Index), as a measure for the assessment of absolute handgrip strength and health-related explosive force in Lebanese adult men, is expressed by the following equation:

$$\text{FHRS\_Index\_MALES (Absolute)} = -38.15473 + (\text{Fmax\_SUM} \bullet 0.05221) + (\text{RFDmax\_SUM} \bullet 0.00673)$$

- Based on the obtained results of the multiple regression analysis (MRA), it can be argued that the prediction algorithm for the classification of the health and fitness related score (FHRS_Index), as a measure for the assessment of relative handgrip strength and explosive force adjusted for body mass in Lebanese adult men, is expressed by the following equation:

$$\text{FHRS\_Index\_MALES (Relative)} = -36.19711 + (\text{Frel\_SUM} \bullet 4.17251) + (\text{RFDrel\_SUM} \bullet 0.53289)$$

For the women of Lebanon –

- Based on the obtained results of the multiple regression analysis (MRA), it can be argued that the prediction algorithm for the classification of the health and fitness related score (FHRS_Index), as a measure for the assessment of neuromuscular performance and training related indicators in Lebanese adult women, is expressed by the following equation:

$$\text{FHRS\_Index\_FEMALES (Discriminant-Based)} = -29.97808 + (\text{RFD}_{max}\text{\_SUM} \bullet 0.00810) + (\text{IS\_L} \bullet 4.77076) + (\text{Weekly Training} \bullet 0.01452) + (\text{F}_{rel}\text{\_SUM} \bullet 2.92873)$$

- Based on the obtained results of the multiple regression analysis (MRA), it can be argued that the prediction algorithm for the classification of health and fitness related score (FHRS_Index), as a measure for the assessment of absolute handgrip strength and explosive power in Lebanese adult women, is expressed by the following equation:

$$\text{FHRS\_Index\_FEMALES (Absolute)} = -24.14104 + (\text{F}_{max}\text{\_SUM} \bullet 0.07640) + (\text{RFD}_{max}\text{\_SUM} \bullet 0.01091)$$

- Based on the obtained results of the multiple regression analysis (MRA), it can be argued that the prediction algorithm for the classification of health and fitness related score (FHRS_Index), as a measure for the assessment of relative handgrip strength and explosive force adjusted for body mass in Lebanese adult women, is expressed by the following equation:

$$\text{FHRS\_Index\_FEMALES (Relative)} = -20.11100 + (\text{F}_{rel}\text{\_SUM} \bullet 4.60987) + (\text{RFD}_{rel}\text{\_SUM} \bullet 0.64475)$$

A significant contribution of this doctorate is represented by defined models intended for application in fitness practice, that is, physical exercise practice, where based only on the basic variables of the handshake test from the aspect of absolute and relative values (sum of maximum forces and sum of maximum explosivities, Fmax_SUM and RFDmax_SUM; Frel_SUM and RFDrel_SUM) the so-called assessment algorithms are defined. health score specific to the population of Lebanese men and women at the level of prediction accuracy of 62.2 to 65.5% (R^2 = 0.622 to 0.655), which have the following form:

- Practitioner models for men of Lebanon:

  Absolute strength model:

  $$\text{Model of Health (Males)} = 0.498 \cdot F_{max}\_SUM + 0.436 \cdot RFD_{max}\_SUM$$

  Relative strength model:

  $$\text{Model Zdravlja (Males)} = 0.472 \cdot F_{rel}\_SUM + 0.421 \cdot RFD_{rel}\_SUM$$

- Practitioner models for Lebanese women:

  Absolute strength model:

  $$\text{Model of Health (Females)} = 0.492 \cdot F_{max}\_SUM + 0.439 \cdot RFD_{max}\_SUM$$

  Relative strength model:

  $$\text{Model of Health (Females)} = 0.462 \cdot F_{rel}\_SUM + 0.428 \cdot RFD_{rel}\_SUM$$

GENERAL CONCLUSION AND CONFIRMATION OF THE HYPOTHESIS

The main hypothesis of the doctoral dissertation was to confirm the assumption that predictive algorithms developed on the basis of hand grip strength parameters can accurately classify body composition and potential health risk among Lebanese adults with statistically significant reliability and validity, taking into account gender differences. Based on the results of discriminant analysis, regression modeling and ROC curve evaluation, this general hypothesis is fully confirmed. The developed models showed high classification performance, with AUC values reaching up to 0.968 in men and 0.992 in women for key predictors such as RFDmax_SUM, while all other primary extracted predictors were statistically significant ($p < 0.001$).

H1, which hypothesized that defined regression-based algorithms using handgrip parameters would be effective for assessing strength, explosiveness, and overall power, was confirmed. The calculated predictive models that included the variables F_{max}, RFD_{max}, IS and as well as relative force values had a high predictive capacity ($R^2 > 0.72$) for health risk classification in both sexes. These algorithms also distinguished individuals at risk with strong sensitivity and specificity, establishing their value for future assessment protocols.

H2, which assumed the possibility of predicting a sex-specific sensitivity difference as a function of defined algorithms, was also proven and confirmed. The structure matrix revealed different sets of given predictors for men and women. For example, weekly training volume and relative strength (Frel_SUM) were predictive only in women, while BMI and Fmax of the dominant arm appeared exclusively in men. Moreover, model structures and threshold values varied significantly by gender, confirming the necessity of gender-specific approaches in algorithm development.

H3, which hypothesized that the most sensitive algorithm (based on correlation with body composition) would accurately estimate health risk, was validated and confirmed. RFD_{max}_SUM, the best-ranked predictor in both sexes, also showed the highest correlation with health status ($p < 0.001$) and gave the best ROC performance. This confirms its utility as a universal marker of neuromuscular health and body composition-related risk in the Lebanese adult population.

H4, which assumed the possibility of a strong correlation between hand grip strength and body composition indicators, was partially confirmed. Although significant associations were found between handshake-derived variables (especially RFD and IS) and body composition indices such as SMMI, FFM, and BMI, some fat-related parameters (eg, PBF, FMI) showed weaker or nonsignificant differences between clusters. However, this limitation was solved by integrating markers of functional performance into the models, increasing their discriminatory power beyond themselves ie. individual static measures of fat.

Generally speaking, the main hypothesis and all four supporting hypotheses were either fully or partially confirmed. Doctorate i.e. the study succeeded in producing scientifically valid, statistically significant and practically applicable algorithms for profiling and predicting health potential in the Lebanese adult population. The resulting models provide a strong basis for clinical application, screening for physical fitness potential, and the ability to monitor health potential at the national level, especially in contexts where comprehensive assessments of body composition alone are impractical.

LIMITATIONS OF THE STUDY AND RECOMMENDATIONS FOR FUTURE RESEARCH

Although this study offers new insights into the use of handgrip strength and explosive force with body composition predictors in health risk assessment in Lebanese adults, certain limitations must be noted.

First, in the project, the intended sample size of 1000 participants was not reached. The candidate emphasized that due to the socio-political instability and prolonged closures caused by the war and economic crisis in Lebanon, the recruitment of participants and access to laboratory facilities were severely limited. The final sample of 395 individuals, although sufficient for successful statistical modeling, limits the full generalizability of the findings to the entire national population.

Second, the study did not include biochemical markers or clinical health diagnostics such as blood glucose, lipid profiles, or inflammatory biomarkers. As such, diseases such as type 2 diabetes, hyperlipidemia, and metabolic syndrome-which are closely related to body composition and functional status-were not directly measured. Inclusion of these clinical health markers would enable more accurate validation of predictive models in relation to cardiometabolic risk and real risk of chronic diseases.

Third, although this study assessed muscle function and composition through handgrip strength and body composition via bioimpedance, it did not assess sarcopenia or other musculoskeletal conditions using standardized diagnostic criteria (eg, muscle quality via ultrasound, physical performance via gait speed, or sit-to-stand tests). As a result, the models are theoretically indirectly related to sarcopenia and general frailty, but have not been formally validated against clinical diagnoses of these conditions.

Fourth, handgrip strength variables were normalized solely to body mass, but not to body height or body surface area. While relative strength per kilogram provides useful insight, height-normalized values-such as allometric scaling or grip strength-area ratios-could provide additional predictive precision and explain interindividual variability in skeletal dimensions.

Fifth, the study was cross-sectional in nature. Although it enabled the identification of correlations and classification models, it did not assess causal relationships or the evolution of health status over time. Longitudinal studies would be necessary to validate the predictive capacity of the proposed models for future health outcomes.

Finally, although the discriminant and ROC-based models showed strong performance metrics, their external validity should be further tested in other Arab and Mediterranean populations, as well as in clinical subgroups with known comorbidities or different physical activity levels.

LITERATURE

In the list of literature used for the preparation of the dissertation project, the candidate lists 129 references, mostly from high-reference journals, which provided a high scientific basis for an adequate and high-quality scientific explanation of the results of the dissertation.

OPINION AND PROPOSAL OF THE COMMISSION

Candidate Zahi Andraosa's doctoral dissertation resulted from the original research carried out in Lebanon, and with the obtained results, it has a high practical application potential in the system of sports and physical exercise, but also in the health system at the national level. The results of the dissertation showed that they have a high level of scientific basis, as well as an innovative methodological approach in looking at the researched issues, and are particularly valuable from the aspect of the climate of research implementation (Lebanon). For the first time, the obtained results define valid, sensitive and specific algorithms by means of which it is possible to classify and assess the potential of body and physical status as a function of health risk in the studied sample of Lebanese adults, using a methodologically and scientifically based method with the application of a standardized handshake test, the bioimpedance method for assessing body composition and simple variables from the field of physical exercise habits. The obtained results give the possibility of application in fitness and health practice and give a realistic picture of the risks and the general health and physical condition of adults in Lebanon.

In accordance with the above, the Commission considers that the doctoral dissertation of doctoral student Zahi Andraos entitled: "SENSITIVITY OF DIFFERENT HAND GRIP ALGORITHMS IN CLASSIFICATION OF BODY COMPOSITION STATUS RELATED TO HEALTH AMONG LEBANESE ADULTS" can be accepted in its entirety, and proposes to the Teaching and Scientific Council of the Faculty to accept this report on the positively evaluated doctoral dissertation, and to refer it for further consideration to the competent Council of Scientific Affairs of the University of Belgrade in accordance with the positive legal regulations.

Members of the commission:

1. Dr. **Vladimir Ilić**, full professor, University of Belgrade - Faculty of Sport and Physical Education of education, chairman of the commission

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2. Dr. **Dragan Mirkov**, full professor, University of Belgrade - Faculty of Sports and Physical Education of education, member

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3. Dr. **Miloš Maksimović**, full professor, University of Belgrade - Faculty of Medicine, member

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Belgrade, 8.9.2025.