



**REVIEW**

from Professor Anna Naidenova Tolekova

Department of Physiology, Pathophysiology and Pharmacology,  
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of a dissertation for awarding the educational and scientific  
degree 'doctor'

field of higher education: Natural sciences, mathematics and informatics

professional field: Biological Sciences

PhD Program "Physiology"

Author: **Veselin Atanasov Vasilev, MD**

Dept of Physiology, MU-Plovdiv

Title: “ **EFFECT OF SELECTIVE ANDROGEN RECEPTOR MODULATORS (SARM) ON PHYSICAL WORK CAPACITY AND SOME SIDE EFFECTS IN AN EXPERIMENTAL MODEL** “

**Scientific supervisor: Prof. Dr. Nikolay Boyadzhiev, PhD**

***General presentation of the procedure and the PhD student***

The complete set of documents, submitted by the candidate, Dr. Veselin Atanasov Vassilev, was prepared in accordance with the requirements of the ŽRASRB, the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the relevant Regulations of the MU - Plovdiv.

***Brief biographical data of the PhD student***

The PhD student graduated "master" degree in medicine in 2018 at MU-Plovdiv, where he began his professional career as an assistant at the Department of

Physiology in 2019. In 2023, he defended his specialty in physiology. In February 2023, he was enrolled as a doctoral student in independent training. He is fluent in English and has the computer skills, necessary to carry out research work.

### ***Relevance of the topic and appropriateness of the set goals and tasks***

The relevance of the developed problem is determined on the one hand by the fact that in the last decade the use of anabolic preparations has increased significantly, not only among athletes. This uncontrolled intake leads to the manifestation of a number of side effects, affects the mental and physical health of the population and represents a serious public health problem. On the other hand, their effects have been observed, that have a positive therapeutic effect in a number of socially significant diseases. For example, it is known that low testosterone concentration correlates negatively with increased cardiovascular risk and its main parameters. This directs the attention of a number of authors to the study of non-steroidal selective androgen receptor modulators, in which negative side effects are minimized. Obviously, this idea motivated the author of the dissertation to develop and implement such a study.

### ***Knowledge the problem***

A reflection of the author's in-depth research, whose main goal is to acquire competence in the main aspects of the scientific problem, the basis of the dissertation development is the systematization of the material in the literature review. In it, he presents an extensive and precise analysis of the studied issues. At the outset, Dr. Vassilev examines the main differences between the two major groups of selective androgen receptor modulators, namely nonsteroidal and steroidal representatives. The differences in the kinase pathways used, as well as the insensitivity of non-steroidal modulators to  $5\alpha$  reductase and aromatase, which determine the tissue selectivity and side effects of selective androgen receptor modulators, are very precisely noted. The author has also systematized the effects, known from the literature on the main target tissues and organs. Of interest are the

possibilities for the treatment of breast cancer, in the type that has expressed androgen receptors. The adverse effects observed so far are also described in great detail and in good faith.

Based on this analytical overview and the conclusions drawn from it, the candidate has formulated the purpose and tasks of the dissertation work. They fully correspond to the conclusions of the literature review about the need for additional studies to clarify the mechanisms of effects of selective androgen receptor modulators and their possible side effects.

All of the above gives me reason to highly appreciate the doctoral student's creative and analytical approach to researching the problem.

### ***Research methodology***

The section "Materials and methods" begins with a detailed description of the design of the set experiment, the formation of the separate groups, the way of conducting the submaximal training and the application of ostarine or ligandrol. A very wide range of methods were used to implement the study: morphometric, clinico-laboratory parameters, histological techniques such as PAS-reaction, myogenic expression of myostatin, somatomedin and VEGF-A. Some functional parameters such as maximal sprint speed, submaximal endurance, maximal time to exhaustion, maximal oxygen consumption, respiratory quotient and energy expenditure were also tracked, as well as the amount of food intake and time spent sleeping. The study was very well planned and conducted, and the results obtained are of high informative value and allow for accurate evaluation and analysis. Statistical methods suitable for the purposes of the dissertation were used: parametric and graphical methods, one- and two-factor variance analysis.

### ***Characterization and evaluation of the dissertation work***

Presented dissertation project for obtaining the scientific and educational degree "Doctor" is on the topic " EFFECT OF SELECTIVE ANDROGEN RECEPTOR MODULATORS (SARM) ON PHYSICAL WORK CAPACITY AND SOME SIDE EFFECTS IN AN EXPERIMENTAL MODEL" was developed in a volume of 174 pages and contains 90 figures and 53 tables. The literary sources used by the author to write the

dissertation are 256 in number, the majority of which are dated after the year 2000. The literature review is written on 29 pages and represents a summarized and detailed reading of a large number of literary sources in recent years. It makes a very good impression that the last page of the review is dedicated to the main conclusions of the literature review regarding the availability of data on the issue and factors that determine the need for additional studies on the issue. In detail, my assessment of the review's qualities is reflected in the section on knowledge the problem. In the chapter "Results and discussion" the description of the results and their discussion are combined, the latter being presented in two separate subsections depending on the applied impact. The influences of the preparations and the training process on the individual studied variables were examined sequentially. The data obtained during the conduct of the studies are very well described, and the results of their processing are illustrated by graphical images, photos of the histological preparations and tables, which differ in their characteristics. The most appropriate illustrations have been skillfully selected to illustrate the obtained data and the relationships between them. The discussion is logically structured and shows the candidate's ability to analyze the data obtained and make a correct comparison with those of other authors who worked on the problem.

The author has used 255 literary sources reflecting the state of research on the problem mainly in the last two decades.

Based on the analysis of the literature data and the own results, conclusions (11 in number) were formulated exactly and precisely. 5 original contributions are formulated that will enrich the scientific knowledge in this area. These relate to effects of the studied selective androgen receptor modulators on physical work capacity and submaximal endurance indicators, established for the first time, and to the multidirectional effects on carbohydrate and lipid metabolism.

### ***Assessment of dissertation publications***

At the time of the defense, the doctoral student has submitted 5 publications on the topic of the dissertation, of which 1 with impact factor and Q1 and 4 in refereed journals. In three of them, the dissertation student is the first author. He also

attached 5 presentations to the dissertation - 4 at international forums and 1 at a national congress.

### **Summary**

The summary is presented in accordance with the standards and requirements for this type of scientific work. It reflects in a compressed and sufficiently informative form the most essential elements of the dissertation work.

### **Personal participation of the doctoral student**

The review of my proposed materials and the leading position of the author in the works for the dissertation development, give me reason to give a high assessment of the personal participation of the doctoral student in the planning and conducting of the experiments, the analysis of the results and in their distribution among the scientific circles.

The dissertation contains original scientific contributions that meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the ŽRASRB and the relevant Regulations for the Development of the Academic Staff of the MU - Plovdiv. The analysis of the material provided and the data from the scientific activity of the dissertation student give me the reason to conclude that the dissertation work shows that the doctoral student Dr. Veselin Atanasov Vassilev possesses in-depth theoretical knowledge, professional skills and competence in the scientific specialty "Physiology" by demonstrating qualities and skills to independently conduct scientific research.

Due to the above, I confidently give my positive assessment of the conducted research, presented by the above-reviewed dissertation work, achieved results and contributions and I propose to the honorable scientific jury to award the educational and scientific degree "doctor" to Dr. Veselin Atanasov Vassilev in a doctoral program in "Physiology".

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Заличено на основание  
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Prof. Anna Tolekova