

✓ **INSTITUTE** *SPORT*

# KOMBINOVANI MODEL TESTIRANJA PERFORMANSI



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Naučna saradnica u oblasti prirodnih nauka



# KOMBINOVANI MODEL TESTIRANJA PERFORMANSI PROVODI SE U SVRHU

- ⚙️ Prilagodbe trenažnog procesa,
- ⚙️ Prevenzije sportskih povreda,
- ⚙️ Identifikacije mladih talenata,
- ⚙️ Predikcije sportskih performansi.





## VERLAB SPORT OMOGUĆAVA

Razumijevanje psihofizičkih potreba uzimajući u obzir različite biofizičke, genetičke i psihološke aspekte koji čine život sportiste.



## VERLAB SPORT POMAŽE

Razumijevanju međudjelovanja navedenih aspekata kako bi se na najbolji mogući način pristupilo povećanju performansi i sportskog uspjeha kroz sprečavanje i ublažavanje sportskih povreda.



**FAZA 1**

**GENETIČKE**

Predispozicije



**FAZA 2**

**PSIHOLOŠKE**

Sposobnosti



**FAZA 3**

**MOTORIČKE**

Sposobnosti



# KVANTITATIVNI I KVALITATIVNI PRISTUP

**KORAK 1** - Upitnik o performansama i sportu

**KORAK 2** - Ergospirometrija

Procjena maksimalnog aerobnog funkcionalnog kapaciteta, uzroka smanjene tolerancije napora, optimizacije treninga s ciljanim otkucajima srca, kao i prognoza kod raznih grupa bolesnika sa srčanim, plućnim i mišićnim oboljenjima.



# KVANTITATIVNI I KVALITATIVNI PRISTUP

## KORAK 3 - Izokinetičko testiranje

Jakosti i izdržljivosti kritičnih grupa mišića, te zglobno mjerenje jakosti nogu i gornjih ekstremiteta

- Procjenjuje mišićnu izdržljivost i balans između strana tijela,
- OptoJump testiranje bilježi sposobnost generisanja reaktivne snage.

## KORAK 4 - Procjena psiholoških i kognitivnih sposobnosti

Primarno kroz stress test koji se izvodi pomoću biofeedback metode.




# KVANTITATIVNI I KVALITATIVNI PRISTUP

**KORAK 5** - Genetička analiza predispozicija

**KORAK 6** - Ekspertska analiza i preporuke





Genetička pozadina svake osobe je nepromjenjiva kada su nasljedne osobine u pitanju, te se ne mogu promijeniti treningom i praksom.

Međutim, ove informacije su itekako korisne za adekvatan dizajn treninga, s ciljem da svaki sportista dobije maksimalnu korist od treninga u skladu s predispozicijama.

Testiraju se genetički markeri:



*ACE rs1799752 (I/D polimorfizam), koji upućuje na veću sklonost ka disciplinama u kojima dominira snaga (D alel), odnosno izdržljivost (I alel)*



*ACTN3 rs1815739 (R577X), pokazuje sklonost sportiste ka umaranju mišića i sportskim povredama.*



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# FUNKCIONALNO TESTIRANJE



## Prilagođeno sportskim disciplinama:

Indikatori fizičke spremnosti, mišićne snage i efikasnosti pretvaranja snage u pokret.

Indikatori balansa i simetrije mišićnog skeleta.

Indikatori kariorespiratorne kondicije.

Indikatori osjetljivosti na stress.



**Sva mjerenja se vrše u kontrolisanim uslovima pod nadzorom stručnjaka!**



Ergospiometrija

**Protokol testiranja  
primjenljiv je na  
profesionalne sportaše i  
rekreativce, te na sve dobne  
skupine.**



Izokinetička testiranja  
i stress test

# DOSADAŠNJI REZULTATI

20  
24





# STUDIJSKA GRUPA

## STAROST

Srednja starost: 17.66

Raspon godina: 12 – 28

11.43 % mlađih od 16 godina

62.86 % od 16 do 18 godina

25.71 % starijih od 18 godina

## SPOL

62.86 % muškaraca

37.14 % žena

## DISCIPLINA

20.00 % atletika

2.86 % plivanje

74.29 % skijanje

2.86 % taekwando

**35 UZORAKA**



# POSTIGNUTI REZULTATI

Individualni izvještaji o trenutnim sportskim performansama za 35 sportaša.

01

ACE gen ima najveći utjecaj na određivanje predispozicija za sportske discipline.

02

Određivanje trenažnih pragova za standardni trening izdržljivosti ili visoko intenzivni intervalni trening.

03

Određivanje brzine reagovanja na stres.

04

Određivanje brzine oporavka nakon stresne situacije.

Identifikacija ispitanika s predispozicijama za bavljenje sportom u kategoriji "elitni sportista".



# Enhancing Sports Performance by Insights from Genetic Testing of Young Athletes from Bosnia and Herzegovina

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## Abstract

The combined results of testing the athletes encompasses the assessment of basic health status, psychological stress testing, and genetic testing, whereby genetic predisposition is important for determining the athlete's predisposition for specific disciplines and risk of sports-related injuries. The investigated athletes' ACTN3 status of the population carrying the gene ACTN3 (rs5742853) is one of the most studied polymorphisms, with the T allele linked to enhanced performance in running and power and generally to decreased running endurance, while the C allele is associated with sports requiring strength and power. The ACTN3 status (rs5742853 polymorphism) is linked to athletic performance, with the C allele associated with better results in sprinting-related sports and a better response to interval training protocols, while the T allele is linked to better endurance and is associated with increased likelihood of injury due to repetitive training process. This reporting additional studies. An analysis comparing the final results of genetic testing of 30 young athletes on their own genetic polymorphisms (DNA isolation from whole blood samples was done using the PurePrep™ Genetic DNA Mini kit, followed by amplification of target polymorphisms using real-time PCR with TaqMan SNP assays. Regarding ACTN3 genotype, 50.0% of successfully analyzed participants were C/C (homozygous C/C), 30.0% were T/C heterozygous (T/C), and 20.0% were T/T homozygous (T/T). The results were inconclusive for the participants regarding ACE testing. All participants were successfully genotyped and none of them carried the associated loss. All participants were C/C homozygous. The results on genetic testing could serve as valuable guidance for optimizing training based on the obtained results, potentially reducing the frequency of athletes' injuries.

**Key words:** genetic testing of athletes, ACE, ACTN3, strength and endurance, power, sports-related injury

## Introduction



Figure 1. Combined testing model of athletes' performance determined by genetic tests

Multi-disciplinary genetic testing involves using various techniques to improve sports performance, with the goal being the identification of talented young athletes, enhancing their performance by optimizing training, and providing them with genetic insights. This study investigated the genetic predisposition of the population model for testing the athletes to see how genetic factors affect the athletes' ability to learn and perform athletic skills. The model also includes genetic testing and personal cognitive testing. By combining these three pillars, we can create a comprehensive testing of users that provides individual recommendations about an athlete's unique performance strategy, program, and genetic insights, which can help them reach their goals. Identifying the genetic predisposition allows us to assess 1152 genetic factors associated with athletic endurance and to assess 80 genetic markers associated with athletic strength. Identifying genetic markers helps the athletes' performance strategy (MPO), which impacts physical capacity to train, and makes it clear if genetic testing can be the right gene "fit". We have identified genetic predisposition on these two genes by a set of 30 gene polymorphisms from 1000 to see what value we can obtain by type of testing.

## Materials and Methods

- Athlete blood samples were obtained from 30 young athletes.
- DNA isolation was performed using the QIAzol lysis reagent (Qiagen) and the RNeasy Lysis Buffer (Qiagen) according to the manufacturer's instructions.
- DNA quantification and purity analysis were performed using spectrophotometry using the NanoDrop 2000c (ThermoFisher Scientific, Waltham, MA).
- Genotyping was performed using the TaqMan SNP Assays (Applied Biosystems, Foster City, CA) and the TaqMan SNP Assays (Applied Biosystems, Foster City, CA) according to the manufacturer's instructions.
- Athlete performance was assessed using a 1000m sprint test and a 1000m run test.

## Results and Discussion



We analyzed genetic predisposition for the ACTN3 and ACE genes among 30 young athletes participating in sports performance testing. The ACTN3 gene is a polymorphism that affects athletic performance, with the C allele linked to enhanced performance in running and power and generally to decreased running endurance, while the T allele is associated with sports requiring strength and power. The ACTN3 status (rs5742853 polymorphism) is linked to athletic performance, with the C allele associated with better results in sprinting-related sports and a better response to interval training protocols, while the T allele is linked to better endurance and is associated with increased likelihood of injury due to repetitive training process. This reporting additional studies. An analysis comparing the final results of genetic testing of 30 young athletes on their own genetic polymorphisms (DNA isolation from whole blood samples was done using the PurePrep™ Genetic DNA Mini kit, followed by amplification of target polymorphisms using real-time PCR with TaqMan SNP assays. Regarding ACTN3 genotype, 50.0% of successfully analyzed participants were C/C (homozygous C/C), 30.0% were T/C heterozygous (T/C), and 20.0% were T/T homozygous (T/T). The results were inconclusive for the participants regarding ACE testing. All participants were C/C homozygous. The results on genetic testing could serve as valuable guidance for optimizing training based on the obtained results, potentially reducing the frequency of athletes' injuries.

## Acknowledgements

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# DRUGI BH. SIMPOZIJ LABORATORIJSKIH GENETIČARA I MOLEKULARNIH BIOLOGA SA MEĐUNARODNIM UČEŠĆEM

10. - 11. 5. 2024. godine  
 Prva nagrada za najbolji poster



# ZAŠTO

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- 1. Razumijevanje genetičkih faktora.**
- 2. Integrisana evaluacija mentalne i fizičke spremnosti.**
- 3. Optimizacija planova treninga.**
- 4. Prevencija povreda.**
- 5. Efikasnost rehabilitacije.**
- 6. Analiza praćenih parametara olakšava izradu, korekciju i kontrolu plana i programa treninga te optimizaciju doziranja i distribucije trenažnih opterećenja.**

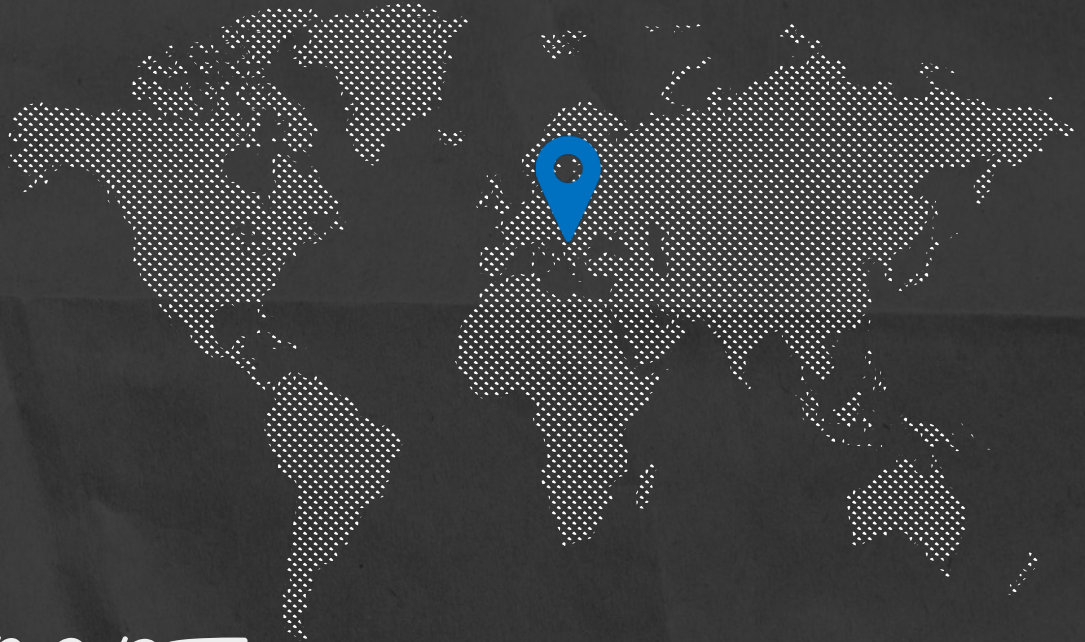
Longitudinalno praćenje promjena na testiranim i mjerenim antropološkim sposobnostima i karakteristikama!



Hvala na pažnji!

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