DR.SC.-01 REQUEST FOR APPROVAL OF THE DISSERTATION TOPIC[1]

GENERAL INFORMATION AND PERSONAL CONTACT INFORMATION OF THE DOCTORAL CANDIDATE

First and last name, and title of the doctoral candidate:	Feng Li, Master 's degree
Provider of the study programme:	Faculty of Kinesiology, University of Zagreb, Croatia
Name of the study programme:	Doctoral study of kinesiology
Scientist ID of the doctoral candidate:	
Approval of topic for acquiring a PhD *(please fill in appropriate box)*:	☒ within programme-based doctoral study ☐ on the basis of scientific achievement
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CURRICULUM VITAE OF THE DOCTORAL CANDIDATE

Education *(in chronological order, with most recent first)*:	2019/2020: Attended the doctoral study program 2016-2019: Master's degree in Beijing Sport University 2012-2016: Bachelor's degree in Anyang Normal University 2008-2012: Linzhou Experimental High School 2004-2008: Chadian First Middle School 1998-2004: Xiaopo Primary School
Work experience *(in chronological order, with most recent first)*:	2016-2018: Beijing Yao Ming Basketball School 2016/2017: U19 Chinese National Men's Basketball Team
Bibliography and active participation in conferences:	Borović Gregov, I., **Li, F**., Očić, M., Bon, I. & Dukarić, V. (2020) Razlike u skok šutu kod košarkaša kadetskog uzrasta za 2 i 3 poena u određenim kinematičkim parametrima. U: Milanović, L., Wertheimer, V. & Jukić, I. (ur.)18. GODIŠNJA MEĐUNARODNA KONFERENCIJA KONDICIJSKA PRIPREMA SPORTAŠA 2020.

TITLE OF THE PROPOSED TOPIC

Croatian:	
English:	Influence of fatigue on kinematic parameter of basketball fundamental skills-passing, shooting and dibbling

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[1] Please name file as: DR.SC.-01 – Last name and first name of Doctoral Candidate.doc
Please send the filled -out form DR.SC.-01, in electronic and written format, and signed, to the appropriate Registrar's Office.

Title in the language of the dissertation (if it is not Croatian or English)	
Area/field/branch (if the doctoral study is performed in a branch)**:**	Biomechanics-Basketball

PROPOSED OR POTENTIAL MENTOR(S)
(name the second mentor in case of interdisciplinary research or if there is another reason for more than one mentor)

	First name and last name, and title:	**Institution, country:**	**E-mail:**
First mentor:	Damir Knjaz	Faculty of Kinesiology, Croatia	damir.knjaz@kif.unizg.hr
Second mentor:			

MENTOR'S COMPETENCES – list of up to five relevant works published in the last five years

First mentor:	1. Knjaz, Damir; Rupčić, Tomislav; Antekolović, Ljubomir. Application of modern technology in teaching and training with special emphasis on basketball contents. // Physical Education and New Technologies / Novak, Dario ; Antala, Branislav ; Knjaz, Damir (ur.). Zagreb: Croatian Kinesiology Association, 2016. str. 112-122.
	2. Rupčić, Tomislav; Knjaz, Damir; Baković, Marijo; Devrnja, Antonela; Matković, Branka. Impact of fatigue on accuracy and changes in certain kinematic parameters during shooting in basketball. // Hrvatski športskomedicinski vjesnik, 1 (2015), 30; 15-20.
	3. Štefan L, Sporiš G, Krističević T, et al. Associations between sleep quality and its domains and insufficient physical activity in a large sample of Croatian young adults: a cross-sectional study BMJ Open 2018;8:e021902. doi: 10.1136/bmjopen-2018-021902.
	4. Vodička, Tomáš; Zvonař, Martin; Pačes, Jiři; Knjaz, Damir; Ružbarský, Pavel; Zháněl, Jiří. Strength values of shoulder internal and external rotators in junior tennis players. // Kinesiology : international journal of fundamental and applied kinesiology, 50 (2018), 2; 181-187 doi:10.26582/k.50.2.9 (međunarodna recenzija, članak, znanstveni).
	5. Krtalić, Slaven; Krističević, Tomislav; Knjaz, Damir. Aging and physical activity. // Hrvatski športskomedicinski vjesnik, 31 (2016), 1; 3-8. (https://www.bib.irb.hr/830833) (podatak o recenziji nije dostupan, pregledni rad, znanstveni).
Second mentor:	

TOPIC OUTLINE

Summary in Croatian *(no more than 1000 characters with spaces):*	
Summary in English *(no more than 1000 characters with spaces):*	The fundamental skills are the foundation for success at all levels of basketball and all players must learn to execute the fundamental skills properly and quickly in order to be successful (1). Also passing, shooting and dribbling are the basic and most frequently used technical skills in basketball competition (2-4). Thus, the aims of this doctoral thesis are threefold: (1)The first objective of this research is to examine whether the kinematics of passing elements will be changed when the player is under the influence of fatigue as well as to identify if the change in kinematic parameters affects the passing accuracy, (2) to determine if shooting precise will be decrease and to determine the kinematic changes when players are under the condition of progressive physiological loads and (3) to assess if the dribbling performance will be deteriorated and to examine the kinematic changes of dribbling when players are under the fatigue condition. The study will include 10 U20 players from 2 best basketball clubs in Croatia. The fundamental skills will be objectively assessed by using Xsens suit and smart basketball when players are with and without fatigue. The result of our study will help in figuring out the patterns of movement in basketball fundamental skills when player is under fatigue condition and help coach to design an appropriate training that could enhance players' fatigue resistance in basketball passing, shooting and dribbling. This dissertation will be written in Scandinavian-type form.

Introduction and overview of research conducted hitherto *(suggested length: 7000 characters with spaces)*

Basketball is one of the world's most popular and widely viewed sports, played in more than 200 countries (5). To be a successful basketball player and to have a competitive team, fundamental skills must be highlighted (6).

Basketball is an intermittent sport that involves both intensive short movements (e.g., jumping, sliding, sprinting) and less intensive activities that last longer (e.g., walking, running). Thus, the physiological demands of a basketball game on players, which requires both aerobic and anaerobic energy delivery systems, were claimed to be high (7). Although some players have highly developed skills, it is possible that players' fundamental skills could be changed and cause poor performance while the player is under fatigue condition. As a result, fatigue becomes an indispensable part of the game that may deteriorate performance, coordination and the skill of a player (8) and yet players are expected to perform well under fatigue conditions. Moreover, some researches have shown that the blood lactate levels, mean heart rates and VO2 max of the players during a competitive game were found to be close to their maximal values (9-11).

Many researches have stated the importance of the fundamental skills of basketball (1-3). For example, Krause noticed, in his book called Basketball Skills & Drills, that the basic skills are the foundation for success at all levels of basketball and all players must learn to execute the fundamental skills properly and quickly in order to be successful (1). Also, Sergio,Keisuke,Jianyu and Nunes respectively reported that passing, shooting and dribbling are the basic and most frequently used technical skills in basketball competition(2) (3) (4) . Furthermore, these three technical skills have been used for NBA all-star skills challenge competition many years, which implies that technical skills of passing, shooting and dribbling is emphasized in high-level players. Considering the importance of fundamental skills in basketball, it is necessary to use scientific methods to objectively evaluate players' skills and to help players improve their shortcomings, which subjective or traditional method could not observe.

During the offense, players are required to keep the possession of the ball and cooperate to create optimal shooting options. Also, accurate pass is required for increasing of effectiveness. Teams that assist more are more likely to win the game (12). On the other hand, reductions in turnovers (i.e., lost possession) increase the winning odds, particularly in games where opponents have similar chances of winning the game (13). According to a research, the passing technique is the main distinguishing factor between starters and non-starters in elite competitions. Therefore, players' performance and season-long success in basketball are particularly based on passing skills (14).

Shooting is the main and most effective means of scoring in basketball games (15) . It represents the base in hierarchical structure of basketball game knowledge (16). The main characteristic of the mentioned element is the fact that it enables shooting the ball towards the basket from greater distances. As such, this element of basketball technique was a result of the players' desire and need to find the best solutions in new situations.

Dribbling consist of an important part of the basketball game, Scanlan reported that players in semi-professional spend 9–11% of playing time dribbling during basketball competition (17). Furthermore, Scanlan used Time–motion- analysis found out that dribbling to maintain ball control is imperative during latter periods in professional game (18). Considering basketball game is a high intensity activity, dribbling and controlling the basketball become more complicated when the players face the fatigue condition. Therefore, dribbling technique is important in basketball, particularly when the scores between two teams are very close during the critical stage of the game.

As mentioned above, basketball is a high-intensity team sport which may affect players' passing technique during fatigue condition. However, there are a few authors that investigated the difference of basketball passing pre and post fatigue (19-20), and presented researches were mainly focused on the passing accuracy or ability and no kinematic parameters used in their study. Moreover, despite several research have studied the change of passing accuracy in the influence of fatigue, movement patterns of passing in different conditions still remained unanswered such as the angular velocity in shoulder or elbow, the joint angle of elbow or knee. The kinematic analysis represents an objective method to observe basketball players' technical skills (21), which can provide a scientific explanation for mistakes in skills performance. In addition, it can aid in enhancing the clarity and minimizing the degree of the mistake made by youth players. Coaches will be able to identify problems with basic skills in fatigue condition and to design an appropriate training that could enhance players' fatigue resistance in passing and other technical skills such as shooting and dribbling. Antonios in his research reported that chest pass, overhead and push pass are most commonly used in basketball game but push pass should be given more attention because it is important in situation where players are under defense pressure (22). In this part, the kinematic change of push pass in basketball will be observed as players are under the fatigue condition.

A number of researches (23-25) have revealed that there are statistically significant differences in kinematics parameters in basketball shooting with and without fatigue conditions. However, most of researches in kinematics involved in senior players. There is a need to determine if shooting training in real, situational conditions, especially while the junior players are under the influence of fatigue will produce better results. The jump shot is one of the most common way of shooting in basketball (26). In this part, the kinematic change of jump shot will be examined when players are under the influence of progressive physiological loads.

There is little research involved in basketball dribbling. Most them was focused on assessing players' speed of dribbling or the level of dribbling by experts' evaluation. To our best knowledge, there is no research on the effect of fatigue on basketball dribbling as well as there is no research on the change of kinematic parameters on basketball dribbling. In this part, the kinematic change of dribbling in basketball will be observed when players are under the fatigue condition.

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Therefore, the aim of this study has three folds. The first objective of this research is to examine whether the kinematics of passing elements will be changed when the player is under the influence of fatigue as well as to identify if the change in kinematic parameters affects the passing accuracy. The second aim of this study is to determine if shooting precise will be decrease and to determine the kinematic changes when players are under the condition of progressive physiological loads. The third aim is to assess if the dribbling performance will be deteriorated and to examine the kinematic changes of dribbling when players are under the fatigue condition.

Objective and hypotheses of research[2] *(suggested length: 700 characters with spaces)*

The main aim of the doctoral thesis is to determine the influence of fatigue on kinematic parameter of basketball fundamental skills. Based on this aim, it is possible to determine 3 specific aims:

1) To determine the kinematic changes on basketball passing when players are under the influence of fatigue.

2) To examine the kinematic changes on basketball shooting when players are under the condition of progressive physiological loads.

3) To assess the kinematic changes on basketball dribbling when players are under fatigue condition.

Hypotheses of these research are:

In general

H1: The passing accuracy would not decrease when players are under the influence of fatigue condition.

H2: The shooting percentage would not decrease when the physiology load is progressive.

H3: The dribbling performance evaluated by basketball experts and technology would decline under the influence of fatigue condition.

In specific

H1: There are differences on passing technique in kinematic parameters between with and without fatigue conditions.

H2: There are differences on shooting technique in angular velocities of the upper and lower extremities, as well as in the height at the moment of releasing the ball under the influence of progressive fatigue.

H3: There are differences on dribbling technique in specific kinematics when players are under the fatigue condition.

Material, participants, methodology and plan of research *(suggested length: 6500 characters with spaces)*

In general

This research will consist of three stages that is passing, shooting and dribbling study respectively. The testing of each stage will constitute four days. The testing of these elements will be held respectively in September, November,2020 and February,2021. The age of subjects will be U20 because their techniques are skilled and fixed so that we can observe the kinematic change between with and without fatigue. All players have no health and injury issues. In order to avoid the interference of fatigue on testing, examinee will be asked to restrain training sessions one day before testing as well as they are asked to measure their basal heart rate during the procedure so that we can identify whether they are in non-fatigue state or not prior to each testing. In order to identify the level of fatigue for players, the heart rate (HR) and blood lactate (BL) will be measured. All Participants will be provided with a detailed explanation of the study procedures and gave written informed consent prior to measuring procedure.

The kinematic parameters in this study will be measured with Xsens kinematic suit. Previous studies confirmed the reliability and validity of Xsens kinematic suit for analysing different basketball techniques (25) (27). All variables will be presented in degree/second (°/s). Previous studies have already proved the validity of angular velocity in basketball techniques (23-24).

Study 1 Passing

Participants

10 U20 Croatian basketball players will be included in passing testing. With the use of G*power program, sample size (numbers of passes) was calculated (n=98) that is needed for measurement procedure with statistical significance $p<0.05$; statistical power 0.8; effect size 0.25 and groups.

Variables

In basketball push passing, the following variables will be observed: trunk rotation; maximum and average angular velocity in wrist, elbow and shoulder; angle of the wrist, elbow and shoulder joint.

Test protocol

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[2] The sequence of listing the objective and hypotheses depends on the area of research.

The first day will incorporate anthropometric measurements for personal data collection and test 5 players. The rest of 15 participants will be separated to next 3 days-5 players for each day. Basal heart rate will be collected on 9am between 7:00 and 8:30am under conditions as close as possible to basal: within 30 minutes of awakening, at least ten hours after eating. After a night of recovery, it could be considered that athletes are under fatigue state if basal heart rate increases than usual (28).

Before starting of passing test, players' HR and BL will be measured. After fatigue protocol, the participants' HR and blood lactate concentration will be measured one more time immediately. Then, the same passing test will be conducted again so that we can observe the change of passing accuracy and kinematic under the influence of fatigue.

The specific test that is similar to the passing part of Taco bell basketball skill test will be implemented, which is considered by 5 experts as the closest to the real situation in basketball game. A basket 1.2 meters above the ground is placed vertically near the court corner (the hoop is facing to examinee and 1.5m from the baseline and sideline respectively). Examinee with the ball stands at the top of three points line which is 9 meters from the target and try to pass the ball into basket with one dribble. Players are allowed to try 3 passes before test and passes 6 times both left and right sides when test start. The warmup consists of 5 minutes jogging, 5 minutes specific stretching. According to Mark's research (20), the scoring of the test is as follows:

Eight points are awarded for each pass that hit the target without touch the hoop.

Six points are awarded for every pass that hit the target but touch the hoop once.

Four points are awarded for every pass that hit the target but touch the hoop more than once.

Two points are awarded for each pass that do not hit the target but touch the hoop.

No points were awarded if player does not hit the hoop as well as touch the hoop, or if a pass other than a push pass is used.

The fatigue protocol consists of repetitive 30 m sprints and five consecutive vertical jumps at both ends of the sprints (29). Participants are going to be instructed to accelerate/decelerate as fast as possible during the sprints and to jump as high as possible at each end. Participants complete the fatigue protocol until they complete five round sprint and jump

Data analysis

"Statistica" version 13.5 will be used for the statistical analysis. Basic descriptive parameters will be calculated for all measured variables. The normality of the data distribution will be evaluated using Kolmogorov–Smirnov test. To verify the differences of the kinematic parameter between with and without fatigue conditions, analysis of variance (ANOVA) for repeated measures with Bonferroni post hoc test will be applied. To identify the influence of fatigue on passing accuracy, regression analysis will be used. Results were considered significant when $p < 0.05$.

Study 2 Shooting

Participant

One U20 player as case study will attend to shooting testing.

Variables

In basketball jump shot, the following variables will be observed: angle of the knee and hip joint at the moment of receiving the ball; maximum and average angular velocity of the ankle, knee, hip, shoulder, elbow and wrist joint; highest point at the vertical line in the release of the ball; angle formed by the downward line of the ball in relation to the basket; time between the moment of receiving the ball and the moment in which the ball leaves the hand.

Test protocol

The examinee will perform 30 jump shots from the 6.75 m distance as warm-up, as well as a dynamic stretching before starting with the testing. The examinee then executes three series of jump shots, each consisting of 8 shots from the previously mentioned distance. Prior to the initial testing, the lactic acid concentration of the examinee will be measured after which the examinee start performing the jump shots.

Before the second series of shooting, the examinee execute continued sprints of 4x15 meters (total of 60 meters) with a change of direction of 180 degrees between each sprint, and before the third, last series, he will perform continued sprints of 8x15 meters (total of 120 meters), also with a change of direction of 180 degrees between each sprint.

Immediately, after the both series of sprints, his blood lactate concentration will be determined and then the examinee start with performing the jump shots. The mentioned type of sprint is used to attain physiological load of the player because this type of movement is often present in modern basketball game during many fast changes between defence and offense.

Data analysis

"Statistica" version 13.5 will be used for the statistical analysis. Basic descriptive parameters will be calculated for all measured variables. The normality of the data distribution will be evaluated using Kolmogorov–Smirnov test. To verify the differences of the kinematic parameter between with and without fatigue conditions, analysis of variance (ANOVA) for repeated measures with

Bonferroni post hoc test will be applied. To identify the influence of fatigue on shooting accuracy, regression analysis will be used. Results were considered significant when $p < 0.05$.

Study 3 Dribbling

Participant 3

10 U20 Croatian basketball players will be included in dribbling testing. With the use of G*power program, sample size (numbers of dribbles) was calculated (n=98) that is needed for measurement procedure with statistical significance $p < 0.05$; statistical power 0.8; effect size 0.25 and groups.

Variables

In basketball dribbling, the following variables will be observed: centre of mass, shoulder rotation, speed of sprint while dribbling, angle of knee, hip and head.

Test protocol

The change of direction (COD) dribble sprint test will be used that is similar in design to other COD assessments of basketball dribbling (30). The Change-of -direction sprint test involved players moving around markers placed at even distances. When completing the dribbling trials and alternated hands with crossover dribbles at each marker during the COD sprint (the dribbling hand was the outside hand when moving towards markers). During the testing, 5 basketball experts will give players points ranged from 1 to 10 according to their dribbling technique. Electronic timing gates (Smart speed; Fusion Sport; Brisbane, Australia) were positioned on the start line and endpoint for timing. The fatigue protocol is same to study 1.

Data analysis

"Statistica" version 13.5 will be used for the statistical analysis. Basic descriptive parameters will be calculated for all measured variables. The normality of the data distribution will be evaluated using Kolmogorov–Smirnov test. To verify the differences of the kinematic parameter between with and without fatigue conditions, analysis of variance (ANOVA) for repeated measures with Bonferroni post hoc test will be applied. To identify the influence of fatigue on dribbling speed, regression analysis will be used. Results were considered significant when $p < 0.05$.

Expected scientific contribution of proposed research *(suggested length: 500 characters with spaces)*

There were less researches involved in passing technique of basketball. These studies were related to the influence of fatigue on basketball passing but it was mainly focused on accuracy change. What is the relationship between kinematic and passing accuracy when players are under fatigue condition is still unknown. Numerous studies have investigated the influence of fatigue on kinematic parameter on basketball shooting regarding senior player, but little is known about the influence of progressive physiological loads on basketball shooting in terms of junior player. To our best knowledge, there is no research related to fatigue and kinematic change in basketball dribbling.

Therefore, as opposed to previous study, our research could create an objective method to evaluate basketball players' fundamental skills when players are under the influence of fatigue. It could help coaches to figure out the movement patterns of players with their fundamental skills under fatigue condition that is the real situation during the game. Therefore, these findings would help coaches to design an appropriate training that could enhance players' fatigue resistance in basketball passing, shooting and dribbling.

List of literature cited *(no more than 30 references)*

1. Krause J, Meyer D, Meyer J. Basketball Skills and Drills: Human Kinetics; 2008.

2. Ibáñez SJ, Sampaio J, Feu S, Lorenzo A, Gómez MA, Ortega E. Basketball game-related statistics that discriminate between teams' season-long success. European Journal of Sport Science. 2008;8(6):369-72.

3. Fujii K, Yamada Y, Oda S. Skilled basketball players rotate their shoulders more during running while dribbling. Perceptual and Motor Skills. 2010;110(3):983-94.

4. Wang J, Liu W, Moffit J. Skills and offensive tactics used in pick-up basketball games. Perceptual and Motor Skills. 2009;109(2):473-7.

5. Pojskić H, Šeparović V, Užičanin E. Reliabilty and factor validity of basketball shooting accuracy tests. Sport Scientific And Practical Aspects. 2011;8(1).

6. Krause JV, Nelson C. Basketball skills & drills: Human Kinetics; 2018.

7. Bompa TO. Theory and methodology of training. Kendall. Hunt Publishing Company. Dubuque, Iowa; 1994.

8. Forestier N, Nougier V. The effects of muscular fatigue on the coordination of a multijoint movement in human. Neuroscience Letters. 1998;252(3):187-90.

Form **DR.SC.-01** Request for approval of the dissertation topic – to be filled out by the applicant with the help of the proposed mentor

9.   Abdelkrim NB, El Fazaa S, El Ati J. Time–motion analysis and physiological data of elite under-19-year-old basketball players during competition. British Journal of Sports Medicine. 2007;41(2):69-75.

10.   McInnes S, Carlson J, Jones C, McKenna M. The physiological load imposed on basketball players during competition. Journal of Sports Sciences. 1995;13(5):387-97.

11.   Montgomery PG, Pyne DB, Minahan CL. The physical and physiological demands of basketball training and competition. Human kinetics jounals. 2010;5(1):75-86.

12.   García J, Ibáñez SJ, De Santos RM, Leite N, Sampaio J. Identifying basketball performance indicators in regular season and playoff games. Journal of Human Kinetics. 2013;36(1):161-8.

13.   Gómez Má, Lorenzo A, Jiménez S, Navarro RM, Sampaio J. Examining choking in basketball: effects of game outcome and situational variables during last 5 minutes and overtimes. Perceptual and Motor Skills. 2015;120(1):111-24.

14.   Gòmez M-Á, Lorenzo A, Ortega E, Sampaio J, Ibàñez S-J. Game related statistics discriminating between starters and nonstarters players in Women's National Basketball Association League (WNBA). Journal of Sports Science & Medicine. 2009;8(2):278.

15.   Zambová D, Tománek ĽJS. An efficiency shooting program for youth basketball players. 2012;8(1):87-92.

16.   Trninić S, Trninić M, Jelaska I. Hierarhical structuration of knowledge in the basketball game. Acta Kinesiologica. 2010;4(1):37.

17.   Scanlan AT, Dascombe BJ, Kidcaff AP, Peucker JL, Dalbo VJ. Gender-specific activity demands experienced during semiprofessional basketball game play. International Journal of Sports Physiology Performance. 2015;10(5):618-25.

18.   Scanlan AT, Tucker PS, Dascombe BJ, Berkelmans DM, Hiskens MI, Dalbo VJ. Fluctuations in activity demands across game quarters in professional and semiprofessional male basketball. The Journal of Strength Conditioning Research. 2015;29(11):3006-15.

19.   Ahmed T. The effect of upper extremity fatigue on grip strength and passing accuracy in junior basketball players. Journal of Human Kinetics. 2013;37(1):71-9.

20.   Lyons M, Al-Nakeeb Y, Nevill A. The impact of moderate and high intensity total body fatigue on passing accuracy in expert and novice basketball players. Journal of Sports Science & Medicine. 2006;5(2):215.

21.   Hu X, Mo S, Qu X. Basketball Activity Classification Based on Upper Body Kinematics and Dynamic Time Warping. International Journal of Sports Medicine. 2020;41(4):255-63.

22.   Theoharopoulos A, Laparidis KK, Galazoulas C, Tsitskaris G. A comparative study relating pass between male and female basketball players. Journal of Physical Education & Sport. 2010;26(1).

23.   Rupčić, T., Miškulin, F., Knjaz, D., Antekolović, L. & Dukarić, V. Differences in some kinematic parameters during shooting for two and three points in basketball under influence of different physiological loads. U: Zvonař, M. (ur.)Sport and quality of life: abstract book. 2017.

24.   Okubo H, Hubbard M. Kinematics of Arm Joint Motions in Basketball Shooting. Procedia Engineering. 2015;112:443-8.

25.   Slawinski JP, Louis J, Poli J, Tiollier E, Khazoom C, Dinu D. The Effects of Repeated Sprints on the Kinematics of 3-Point Shooting in Basketball. Journal of Human Kinetics. 2018;62:5-14.

26.   Hay J. The biomechanics of sports techniques: Prentice-Hall; 1978.

27.   Wouda FJ, Giuberti M, Bellusci G, Maartens E, Reenalda J, Van Beijnum B-JF, et al. Estimation of vertical ground reaction forces and sagittal knee kinematics during running using three inertial sensors. frontiers in physiology. 2018;9:218.

28.   Dressendorfer RH, Wade CE, Scaff Jr JH. Increased morning heart rate in runners: a valid sign of overtraining? The Physician and Sportsmedicine 1985;13(8):77-86.

29.   Chappell JD, Herman DC, Knight BS, Kirkendall DT, Garrett WE, Yu B. Effect of fatigue on knee kinetics and kinematics in stop-jump tasks. The American Journal of Sports Medicine. 2005;33(7):1022-9.

30.   Delextrat A, Grosgeorge B, Bieuzen F. Determinants of performance in a new test of planned agility for young elite basketball players. International journal of sports physiology performance. 2015;10(2):160-5.

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Total cost estimate of proposed research *(in kuna)*
50 000 kuna

Proposed sources of funding for research

Type of funding	Title of project	Project leader	Signature
National funding			
International funding			
Other types of projects			
Self funding			
Session of the Ethics Committee at which consent was given to the research proposal[3]			

Agreement of the mentor and the doctoral candidate to request for topic approval

I declare under responsibility that I agree with the topic whose approval is requested.

Signature

(first and last name of first proposed mentor)

Signature

(first and last name of second proposed mentor)

Signature

(first and last name of doctoral candidate)

STATEMENT

I declare under responsibility that I have not submitted a request for approval of an identical dissertation topic at any other university[4].

Zagreb, (date)

Signature

(first and last name of doctoral candidate)

Official stamp here

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[3] Fill out only if needed
[4] Not required in case of dual doctorate (*Cotutelle de these*)