



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

SHSS5061

Research in Health, Exercise and
Physical Education

Sports Therapy Coursework Brief

LEVEL 5

SEMESTER YEAR

MODULE CODE: SHSS5061

Research in Health, Exercise and Physical Education

ASSESSMENT TYPE: ASSIGNMENT

ASSESSMENT/COMPONENT: 002

COMPONENT WEIGHTING: 50 %

WORD COUNT: 2000word

MODULE TUTOR: David Gardner

Research Report:

Following on from assessment point 001, students are required to undertake a piece of experimental research. Students are required to develop a method to answer a specific research question in the field of Sports Science or Sports Therapy. Using the developed method, students are required to collect and analyse data and accept/reject specific hypotheses. Students will then discuss their findings in the context of the existing literature and highlight any resulting practical applications.

The format required for this report is explicitly detailed below:

- 1. Abstract (300 word maximum)**
- 2. Introduction (with literature review)**
 - a. Research aims (hypotheses)**
- 3. Method**
 - a. Participants**
 - b. Design**
 - c. Protocol**

d. Data analysis

4. Results

5. Discussion (including limitations & practical applications)

6. Conclusion

7. Reference list (maximum 30 references)

Students are recommended to read examples of experimental research reports in the Journal of Sports Sciences or the Journal of Orthopaedic and Sports Physical Therapy.

For further guidance on the required content for this report students are directed to the BSc (Hons) Sports Therapy Survival Manual available on the moodle pages.

SUBMISSION DETAILS:

A copy of your research report should be submitted via TURNITIN on your moodle pages NO LATER than 3pm on Friday 8th May 2020.

Assessment Feedback Sheet

Student No./Name: 1805108/ Lewys Wilkes

Module: SHSS5061

Personal Evaluation – to support your academic progress please complete the section below BEFORE submitting your work.										
What do you consider to be the best aspects of this work?	I believe I have conducted a thorough research study which has provided reliable results.									
Which aspects do you consider could have been improved in this piece of work?	I could have gone further into searching the literature to back up my research.									
What have you found most satisfying whilst undertaking this submission?	It was interesting to conduct a full research project and to analyse the results thoroughly to see the impact of the study.									
ASSESSMENT CRITERIA	Learning Outcomes	GRADE								
		Poor < 20%	Weak 20-29%	Unsatisfactory 30-39%	Satisfactory 40 – 49%	Good 50 – 59%	Very Good 60 – 69%	Excellent 70 – 84%	Exceptional 85– 100%	%
Abstract (10%)	1&2	Little or none presented.	Inadequate detail. Lacking essential information. Significant errors and omissions.	Inadequate detail. Lacking important information. Errors and omissions.	Basic overview of all elements required but greater clarity needed.	Good overview of all required elements.	Very good overview of study presented	Comprehensive overview of student presented	Comprehensive, offering new insight	
Introduction (20%)	1&2	Little or no discussion	Insufficient discussion	Limited discussion	Evidence of literature search but limited discussion & synthesis	Evidence of appropriate literature search, discussion and debate	Critical analysis of the literature with sound debate of issues	Comprehensive critical analysis of literature and debate of issues	Full critical analysis of the literature	
Hypotheses (5%)	1&2	None presented	Weak hypotheses that do not reflect the research question	Inadequate relationship between hypotheses and research question	Basic hypotheses set but vague	Research and Null hypotheses set	Research and Null hypotheses succinctly presented	Research and Null hypotheses set with clarity	Research and Null hypotheses set to exceptional standard	
Method: (30%) - Participants - Design - Protocol - Data analysis	1&2	Absent or incorrect	Method incoherent with no ability to reproduce study	Method incoherent with little ability to reproduce study	Method coherent with basic ability to reproduce study	Method coherent with ability to reproduce study	Method detailed, study reproducible	Comprehensive method	Exceptional method, concise and precise	
Results (15%)	1&2	Not presented	Inadequate. Lacks order and detail. Incorrect format.	Unsatisfactory. Vague or incomplete. Incorrect format.	Satisfactory. Basic presentation of the minimum results	Good – clear and appropriate results, correctly formatted	Very good – detailed and appropriate of results	Excellent - detailed and appropriate results.	Exceptional - detailed and appropriate results.	
Discussion (15%)	1&2	Little or no awareness and/or discussion of issues	Insufficient awareness and/or discussion of issues	Limited awareness and/or discussion of issues	Evidence of awareness but limited discussion of issues	Evidence of awareness and debate of issues	Substantial awareness and debate of issues	Comprehensive awareness and debate of issues	Fully aware and able to debate issues	

Conclusion (5%)		Little or no awareness of study conclusions	Insufficient discussion of study conclusions.	Limited discussion of study conclusions	Awareness of conclusions but narrow & lacks synthesis	Awareness of appropriate conclusions, discussion and debate	Awareness of conclusions with sound debate of issues	Comprehensive awareness of conclusions and debate of issues	Exceptional awareness of study conclusions	
Academic skills (P/F)		Does not write appropriately. Has not engaged with Harvard Guidelines.	Attempt to apply Harvard guidelines and Academic Writing with significant inconsistency, errors and omissions	Attempt to apply Harvard guidelines and Academic Writing with inconsistency, errors and omissions	Attempt to apply Harvard guidelines and Academic Writing with some errors and omissions	Attempt to apply Harvard guidelines and Academic Writing with minimal errors and omissions	Basic understanding of Harvard referencing and academic writing	Consistent application of Harvard guidelines and Academic Writing conventions with minor formatting issues.	Adheres fully to Harvard guidelines and academic writing conventions	
It is expected that students will present work that is proof read and follows the School Reference Guide and Assessment Checklist . Therefore a range of 0 – 10 marks will be deducted for non-completion of any of the points on the checklist below .										
TUTOR COMMENTS:										
Submission date: via Turnitin			Return date: (at least within 4 weeks)		Tutor:				Mark:	

Assignment Checklist

X Please complete the **Personal Evaluation** section of the Assessment Feedback sheet, add your name and details, and paste the whole of this assignment document into the front of your assignment

X Submission is a **single pdf file, clearly labelled** with your name and module code

X Font style - Times New Roman, size -12 for text and 14 for headings

X Ink colour – black only

X Line spacing – 1.5 line spacing and 2cm- 2.5cm page margins

X Quotations more than three lines to be indented 1 line spacing

X One line space between paragraphs, paragraphs must be left aligned

X Pagination (your assignment should have **page numbers**)

X All tables and figures are internally referenced and have a title

X **Word count** checked and written at end of text (before references and any appendix)

X Assignment is within 10% of the word limit (excluding references and any appendices)

X **All** references in the text are included in the reference list

X **Correct referencing as described in UWTSD Harvard Referencing Handbook on the Library website** <https://www.uwtسد.ac.uk/media/uwtسد-website/content-assets/documents/library-and-learning-resources/infoskills/harvard-eng.PDF>

X Correct spelling and punctuation, using **UK English**

X Grammar and syntax correct- double check anything that has a green line under it

X I have read my assignment out loud to myself and it makes sense and is easy to read

X Somebody else has read my work and it makes sense to him or her!

X **I have checked and I have not plagiarised**

Abstract

Introduction

Improving dorsiflexion is shown to reduce injury risk within runners (Jeon *et al.*, 2015; Roper *et al.*, 2016). Although there is evidence to suggest there are biomechanical and strength production benefits during weight bearing activity like running (Guillén-Rogel *et al.*, 2017), there have been few studies conducted investigating whether there are performance benefits to be gained from increased dorsiflexion. The purpose of this research study was to investigate whether increasing dorsiflexion can impact endurance running performance.

Method

The study involved a group of twelve participants with an age range of 18-50 years and mixed running ability. Participants completed a knee-to-wall dorsiflexion assessment and a one mile treadmill run. The participants then underwent a four week PNF stretching programme. Following this, all participants were reassessed using the same test procedures.

Results

The results showed a difference in mean dorsiflexion of -0.218 ± 0.087 showing a statistically significant increase in the mean dorsiflexion ROM following the PNF stretching programme. The difference in the mean time for the one mile run of -0.002 ± 0.038 showed no significant improvement.

Discussion

The statistically significant improvement in the mean ankle dorsiflexion ROM after the PNF stretching programme shows that PNF stretching is effective. However, this did not translate to improvements in running performance. Many limitations were encountered in the study including the inability to control training outside the study which may influence performance (Mallol *et al.*, 2017) and the link between decreasing tendon stiffness and reduction in running economy (Boullosa *et al.*, 2020).

Conclusion

The study did not find a statistically significant improvement in running performance as a result of increased ankle dorsiflexion ROM. It could be argued that future studies in this area should be focused on the potential reduction in injury risk associated with improved ankle dorsiflexion ROM.

Introduction

There are many factors which can impact performance within endurance running. These include physiological aspects such as cardiovascular endurance (Lucia *et al.*, 2008) and range of motion (Brown *et al.*, 2011) as well as elements such as running economy (Lucia *et al.*, 2008). Improved ankle dorsiflexion range of motion is one factor which has been widely shown within the literature to have a potential link to reduced injury risk in the foot and ankle (Jeon *et al.*, 2015) as well as within other joints such as the knee (Roper *et al.*, 2016). Improving ankle range of motion has also been shown to influence other aspects including biomechanics within weight bearing activity as well as increasing the strength production of the muscles around the ankle (Guillén-Rogel *et al.*, 2017). Studies have shown that proprioceptive neuromuscular facilitation (PNF) stretching is a more effective method for increasing ankle dorsiflexion range of motion when compared with other stretching techniques such as static stretching (Etnyre and Abraham, 1986). Six week long PNF stretching programmes have been suggested to be effective in increasing ankle dorsiflexion ROM as well as decreasing tendon stiffness (Konrad *et al.*, 2015).

Although the current research has been centred around the potential reduction in injury risk with increasing ankle dorsiflexion ROM (Jeon *et al.*, 2015; Roper *et al.*, 2016), there is some evidence to imply there are also some possible performance benefits to be gained (Guillén-Rogel *et al.*, 2017). As previously stated PNF stretching programmes have been shown to be effective in increasing ankle dorsiflexion ROM (Etnyre and Abraham, 1986; Konrad *et al.*, 2015). Therefore, the purpose of this research was to investigate whether increasing ankle dorsiflexion ROM through PNF stretching programs can improve performance within endurance runners. Prior to the study commencing, two hypotheses were set out. The null hypothesis; there is no statistically significant difference in the performance of endurance runners over a one mile run following a four week period of PNF stretching to improve ankle dorsiflexion ROM. The alternative hypothesis; there is a statistically significant difference in the performance of endurance runners over a one mile run following a four week period of PNF stretching to improve ankle dorsiflexion ROM.

Any performance improvements found within the study would put forward an argument for including PNF stretching programmes in training programmes for endurance runners for both performance benefits as well as the already stated potential reduction in injury risk.

Method

Participants

The participants for this study were recruited via email to both students and staff at the University of Wales Trinity Saint David. There was a total of twelve participants recruited for this study. The group of participants included subjects of both sexes, with a range of running experience and ability a wide age range of 18-50 years. It is sometimes difficult to know how applicable the findings of studies within endurance running are to recreational runners as they are often centred around elite level athletes (Boullousa *et al.*, 2020). Therefore, the group was purposely recruited with this range of gender, age and experience to get a true representation of whether the results of the study are applicable to the majority of endurance runners rather than a specific portion of elite athletes. Prior to the commencement of the study, all participants were screened with a physical activity readiness questionnaire (PAR-Q). As well as this, all participants were required to complete a form to assess any contraindications to PNF stretching the subjects may have and an informed consent form. If any implications arose from this screening process for any of the participants, they would be removed from the study.

Design

This study was set up as a one group pre-test post-test design. The group was constructed of participants of a range of ages, both sexes and a mixture of ability to allow any findings to be applicable across recreational runners rather than just elite groups (Boullosa *et al.*, 2020). The leaders of the research were trained in Knee-to-wall assessment protocols (Konor *et al.*, 2012) as well as the implementation of PNF stretching method protocols (Konrad *et al.*, 2015).

Protocol

Prior to the commencement of the study, each participant completed a PAR-Q, a contraindication to PNF stretching form and an informed consent form. The first week of the study involved the completion of the initial tests required for the studies. The first test carried out was a standardised knee-to-wall assessment (Konor *et al.*, 2012). This assessment took place in a weight bearing lunge position with the heel of the foot in contact with the floor and used a Rolson auto lock tape measure (Reading, UK) with 0.1cm increments (Konor *et al.*, 2012). The participants were asked to lunge forward and touch the wall with their knee (Konor *et al.*, 2012). The foot was then moved back 1cm at a time (Konor *et al.*, 2012). Once the subject could no longer touch the wall, the foot was moved closer in smaller increments to establish the maximum distance of the toe from the wall to the nearest millimetre (Konor *et al.*, 2012). At this point, a digital inclinometer was used to calculate the angle of dorsiflexion (Konor *et al.*, 2012). For the second assessment, all participants first completed a standardised general warm up and dynamic stretching (Yamaguchi *et al.*, 2019) followed by a standardised specific running warm up of 800 metres at a submaximal effort (Ampillo and Ristian, 2014). Following the warm up, each subject completed a one mile maximal effort run. The gradient was set at a constant 0.5% for all participants to attempt to simulate outdoor running conditions (Mugele *et al.*, 2018). The time taken for the subject to complete the run was then recorded.

Following the initial assessments, all subjects were taken through a four week PNF stretching programme. All research leaders were trained in PNF stretching method protocols (Konrad *et al.*, 2015). This involved two sessions of PNF stretching per week. Each session entailed the subjects lying in a prone position. The subject was then put into maximum dorsiflexion for ten seconds by the researcher and then requested to apply a maximal force against the researcher for five seconds (Yuktasir and Kaya, 2009). The position of dorsiflexion was then increased to the new maximal point and the procedure was repeated. This was done one more time at the new maximal point and held in the final position for twenty seconds. This set was repeated a total of four times within each session with a rest period of ten seconds between each set (Yuktasir and Kaya, 2009).

Following the four week PNF programme, each participant repeated the tests completed in week one to allow comparisons to be made between the results.

Data analysis

Data analysis of the results acquired in the study will be carried out using SPSS software. As the study involved a pre-test post-test design of the same group of subjects, a paired t-test was the test used to determine whether the results obtained were statistically significant.

Results

Of the twelve participants, none were required to be removed from the study due to exclusion criteria. The twelve participants all completed all aspects of the study including the initial one mile run as well as a knee-to-wall assessment prior to implementation of the four week PNF stretching program. All participants then repeated these assessments once the four week programs were completed.

Table 1: The effects of PNF stretching programme on mean ankle dorsiflexion ROM and 1 mile Run Time.

	Difference in mean between before and after PNF programme	Confidence interval of the difference	Significance
Ankle Dorsiflexion ROM	-0.218±0.087	-0.406;-0.031	P<0.05
1 Mile Run Time	-0.002±0.038	-0.0835;0.080	NSD

As shown above in table 1, there is a significant difference in the mean ankle dorsiflexion ROM before and after the implementation of the PNF stretching programme. However, this increase in the mean ankle dorsiflexion ROM of the group did not translate into a significant difference between the mean 1 mile run time before and after the implementation of the PNF stretching programme.

Discussion

The purpose of this research was to investigate whether increasing ankle dorsiflexion ROM through PNF stretching programs can improve performance within endurance runners. The data analysis shown in Table 1 demonstrates the difference in the mean values for both ankle dorsiflexion ROM and the one mile run time within the group of twelve participants before and after the PNF stretching programme. It is clear from the results that the mean ankle dorsiflexion ROM for the group showed a statistically significant improvement. This reinforces the aforementioned evidence suggesting that PNF stretching was an effective method of increasing ankle dorsiflexion ROM (Konrad *et al.*, 2015). Despite evidence in the literature suggesting biomechanical and strength production benefits from increasing ankle dorsiflexion ROM (Guillén-Rogel *et al.*, 2017), the mean difference between the one mile run before and after the PNF stretching programmes showed no statistically significant difference. Therefore, the null hypothesis is accepted for this study.

Limitations

There were numerous limitations of this research study. These included the inability to control factors such as the subject's training participation outside of the study during the four week program. Therefore, improvements seen within the group's performance may be down to progressions associated with running training methods such as interval running training including cardiovascular adaptations (Mallol *et al.*, 2017). There is evidence supporting the idea that stiffness in tendons of the foot and ankle are a risk factor to injury in running (Lorimer and Hume, 2016) however, another limitation of this study is that there is argument to suggest reducing tendon stiffness may alter running technique and that this may lead to an increased risk of injury (Boullosa *et al.*, 2020). It is unclear though, the degree to which the implementation of PNF stretching translates to changes in running technique in the long term

(Boullosa *et al.*, 2020). There is also some suggestion that increases in stiffness in tendons of the ankle and foot may lead to improved running economy so PNF stretching may result in a decrease in running economy and therefore have a negative impact on running performance (Boullosa *et al.*, 2020).

Practical applications

Although this study did not show any significant difference in endurance running performance, some practical applications can be made from the findings. The application of PNF stretching programmes resulted in significant improvements in ankle dorsiflexion ROM within the group. This backs up previous evidence suggesting it is an effective stretching technique (Guillén-Rogel *et al.*, 2017). There is also evidence within the literature to suggest that improving ankle dorsiflexion ROM can reduce the risk of injury (Jeon *et al.*, 2015; Roper *et al.*, 2016). Therefore, it could be argued that PNF stretching programmes should be carried out by endurance runners due to the reduction in injury risk and future studies should be centred around exploring the optimal application of this technique and its effect on injury risk further within runners.

Conclusion

The purpose of this research study was to investigate whether increasing ankle dorsiflexion ROM through PNF stretching can improve performance in endurance running. The results showed that within the group of twelve participants, there was significant improvement in ankle dorsiflexion ROM. However, this did not translate to a significant improvement in the one mile run time within the group. Therefore, it could be argued that future studies should focus on the application of PNF stretching and its link with injury risk reduction in runners.

Word count: 2151

References

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