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Acute effects of gluteal warm up on knee valgus motion during jumping and landing in adolescent females.

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Table of Contents

List of Figures

List of Tables.

Table Page

ABSTRACT

This study aimed to assess the effect of a ninety second gluteal warm-up (GW) on knee valgus motion during take-off and landing tasks in adolescent females; assess its efficacy on jump performance; and assess whether those with Generalised Joint Hypermobility (GJH) respond differently. GJH has been linked to greater knee injury risk and gluteal muscle action has been linked to a reduction of knee valgus motion, a known factor in knee injury, as well as improved jump performance. Where warm-up time is limited, a 90 second warm-up that activates the gluteal muscles could prove very useful and this study sought to establish whether this warm-up could acutely affect physical performance and whether it has potential use in injury prevention by reducing excessive knee-valgus motion. Twenty-three active females (age 16 ± 1.38 years, weight 58.43 ± 12.81kg) participated. Joint mobility was assessed using a Beighton's test (scores ≥ 4 being classified as GJH). Participants attended two sessions and carried out both the GW and a standard dynamic warm up (DW). CMJ height was measured using Pasco force platforms and analysed through SparkVue software. Knee valgus angles were recorded during CMJ take-off and landing, as well as drop landings from a 32cm high platform. Angles were assessed using Kinovea 2D video analysis software. Repeated measures ANOVA was used to assess the effects of warm-up on knee valgus motion and jump height. Warm-up did not significantly affect jump height or knee valgus motion and those with GJH did not on the whole, respond differently to their non-hypermobile counterparts. Non-hypermobiles did respond to a gluteal warm-up with a reduction in knee valgus during take-off but no difference during landing was found. In conclusion, the short gluteal warm-up performed equally well when compared to a longer dynamic warm-up suggesting it may be useful in sports settings where speed of preparation is paramount, but it did not appear to be any better at acutely affecting knee valgus mechanics in those with GJH. Key words: Hypermobility, Lower Limb Kinematics, Injury Prevention.

CHAPTER 1

INTRODUCTION

It has long been reported in research literature that knee injuries such as anterior cruciate ligament (ACL) tears and patellar dislocations occur at a higher rate in female athletes taking part in sports involving jumping, deceleration and change of direction, with estimates as high as six times the rates among males (16). Valgus motion, reduction in neuromuscular control and lack of gluteal strength have all been positively identified as risk factors for non-contact ACL injury in females athletes (10,13,14). Females have been more often found to have an imbalance in muscular control and to demonstrate ligament dominance (1,7) where the muscles stabilising the knee do not provide equal support and the ACL acts to limit valgus motion at the knee instead. As such, if the knee moves too far into valgus, then the ACL is placed under greater strain and is at higher risk of injury.

Adolescent females have been found to experience a reduction in neuromuscular control after puberty along with changes in landing mechanics and increases in knee valgus motion which is thought to contribute to high compression forces in the knee joint and to potential injury (6,8,12). A study of female elite junior hockey players found the prevalence of hypermobility to be over 50% and reported higher rates of sports injury amongst those classified as having Generalised Joint Hypermobility (GJH) (12). A meta-analysis has found a significantly higher chance of knee injury in those with GJH (21) and yet there is little research into jumping and landing tasks in this specific population and it is not clear whether GJH itself leads to higher rates of knee valgus or if the two are unrelated.

Intervention programmes focussing on gluteal strength as well as correct movement patterning have been shown to be beneficial in the favourable alteration of landing mechanics and the prevention of knee injury (20). Therefore, any activation activities that could change hip and knee alignment to bring about a more optimal position or increase stability, should be considered for inclusion in the warm-ups of adolescent females (23). The gluteal muscles have not only been identified as important for knee stability in landing tasks, but as important drivers for a number of movements such as running and jumping (18). An emerging area of research is that of low-load gluteal muscle activation strategies. A number of studies have been carried out using protocols lasting for durations of around 7 minutes and consisting of stability and strengthening focussed exercises such as glute bridges and clams (2,4,6). More recently, potentially beneficial changes to movement patterns were demonstrated, by way of altered knee alignment and hip rotation (22), suggesting increased gluteal recruitment and offering a potentially valuable role for injury prevention of these protocols. However, these protocols often require periods of up to 10 minutes rest after their execution, before positive outcomes are realised which do not lend themselves to warm up in competitive sports settings where team substitutes may have as little as one or two minutes to begin play after being called upon.

A potential replacement for the aforementioned gluteal activation protocols is resisted hip extension. It is being used in the physiotherapy and sports preparation settings to provide activation in a short (c. ninety seconds) time and at a low load. Physiotherapist, Douglas Heel (26), has developed the Be Activated method of muscle activation and of interest to this problem, is the inclusion of a simple standing resisted hip extension activity utilising a resistance band or similar. The lower body portion of the activity is similar to kettlebell swings which have been shown to have some dynamic correspondence to vertical jump squats (15) and to contribute to improved jump performance by encouraging an alteration in the proximal to distal sequencing of the lower body extension during jumping and by producing larger net joint moments at the hip in female volleyball players (3). It seems sensible that a warm up that activates the gluteal muscles could well acutely reduce knee valgus motion as well as helping to prime the drivers for explosive performances such as jumping. Given its short duration, it is also hoped that the fatigue encountered in previous low load protocols can be avoided, therefore providing a useful warm up for court- and pitch-side sports such as basketball and netball where athletes have limited time to ready themselves when called upon to play. As such, the purpose of this study was to test the effects of a short gluteal warm up on both knee valgus motion and jump height whilst also assessing whether those with GJH respond in the same way to both tasks and warm up. The hypotheses of this study were that the short gluteal warm up would reduce knee valgus motion in landing and take-off activities and that valgus motion would be greater in those with GJH. It is also hypothesised that the gluteal warm up will be as effective as a longer traditional warm up on CMJ height.

CHAPTER 2

METHODS

2.1 Experimental approach to the problem

To assess the effects of the gluteal focus warm up (GW) in comparison to the standard dynamic warm up (DW) on knee valgus-varus motion and jump height, a repeated measures crossover design was employed to minimise the risks of learning effects. Findings as to whether a learning effect exists between testing sessions where CMJ is tested are mixed, with some suggesting an impact of learning on CMJ performance while others have found CMJ variables to be reliable in their consistency regardless of the level or age of participants and while intra-session learning was present, no inter-session learning effect was found (9,19) It has also been noted that whilst it was not statistically significant, younger athletes can show greater variability in their CMJ measurements (19). In light of these findings, by employing a crossover design, order effects can be mitigated reducing the threat to internal validity. Assessment of knee valgus angle was carried out using frontal plane video collection and Kinovea 2D video analysis software was used to take measurements of maximal valgus angles. The validity and accuracy of 2-D video analysis is well documented (8,24) and was considered suitable for the purposes of this study. Quantification of GJH was carried out by the experimenter using the modified 9 point Beighton score. A commonly used score of $\geq$4 was considered a mark of GJH and the test itself has been validated for use with high intra-rater reliability and no need for further testing to establish GJH (25). Valgus data for both drop landings and CMJ landings and take-off was collected Drop landings are regularly used in landing valgus motion studies but CMJs offer greater ecological validity hence the choice to investigate both. For the assessment of jump height, force platform data was collected during all CMJs, and jump height based on flight time used to calculate individual responses. Whilst this method has been suggested to potentially over-estimate jump height its outcomes are described as sufficiently consistent to and easy to use to make it acceptable (17)

2.2 Subjects

32 sports and psychology students volunteered to take part in the study. Three dropped out before the initial testing session, 1 was deemed unsuitable via PARQ due to a recent ankle injury. A high drop-out rate occurred with a further 5 leaving the study mid-way through. This left 23, of whom full sets of data were collected for 21 (complete video of two candidates' trials was not obtained but their jump height data forms part of the set). Their information can be seen in Table 1.

Subjects (n=23)	Mean age ±SD	Mean Mass (kg)	GJH mean Beighton Score ±SD	Non-GJH mean Beighton Score ±SD
Group 1 (n=13)	16±1.22years	61.78±12.27	n= 6 Mean = 5.5±1.37	n=7 0.86 ±0.9
Group 2 (n=10)	16±1.63 years	54.07±12.78	n=3 mean = 4.33 ±0.58	n=7 mean = 1 ±1.15

Table 1: Subject Characteristics

Ethical approval for this study was obtained through the University Ethics Committee All participants were given information about the study which outlined the potential benefits and risks involved in partaking in the study. Informed parental consent and participant assent was obtained for every participant.

2.3 Procedures

In the first testing session, having filled in PARQ forms, participants were assessed for GJH using the Beighton test (Table 2). Those in Group 1 carried out DW in session 1 and GW in session 2. Group 2 carried out the warm up tasks in the opposing order. Reflective markers were applied to participants on both lateral malleoli, lateral epicondyles, greater trochanters and ASIS as well. A video camera was set directly in front of the test area to capture coronal plane video images of the knees during the landing and take-off tasks. Capture rate was set to 50Hz and infield markers were placed in the experimental set up to allow calibration of the video data in Kinovea 2D analysis software. A pair of PASCO force plates (PASPORT Force Platform PS-2141, PASCO, Roseville CA, USA) measuring 5cm in height were placed in front of a platform giving a drop height for drop landing task of 32 cm. At the beginning of each session, participants stood still for 5 seconds on the platforms to allow a mass to be calculated. Information about jump height and weight were processed using SparkVue software. Force data was gathered for all drop landings and CMJs at 1000Hz.

Beighton Score for range of joint motion and hypermobility

Mobility Task	**Points score**
Thumb to forearm	1 each
Little finger metacarpophalangeal joint extension >90°	1 each
Elbow joint hyperextension >10°	1 each
Knee hyperextension >10°	1 each
Trunk bend – palms flat to floor	1

Table 2. Mobility Assessment. Scoring ≥4 is considered GJH.

In both conditions of the warm up, participants spent 5minutes on a static exercise bicycle ergometer and were asked to peddle at a level that kept them warm but did not cause them to feel tired. Participants then carried out their prescribed warm up. See Figure 1 for GW protocol. DW consisted of 5 minutes standard dynamic warm up exercises that all participants were accustomed to including inchworms, walking lunges, high knees walking and skipping, crab walks, side shuffles, jogging and running accelerations. GW consisted a guided warm up carrying out dynamic hip flexion and extension against a resistance band for 60seconds followed by 30seconds of knee lifts whilst maintaining hip extension, forward lean and a straight supporting leg throughout. See figure 1

Figure 1. Gluteal Focus Warm-up Protocol

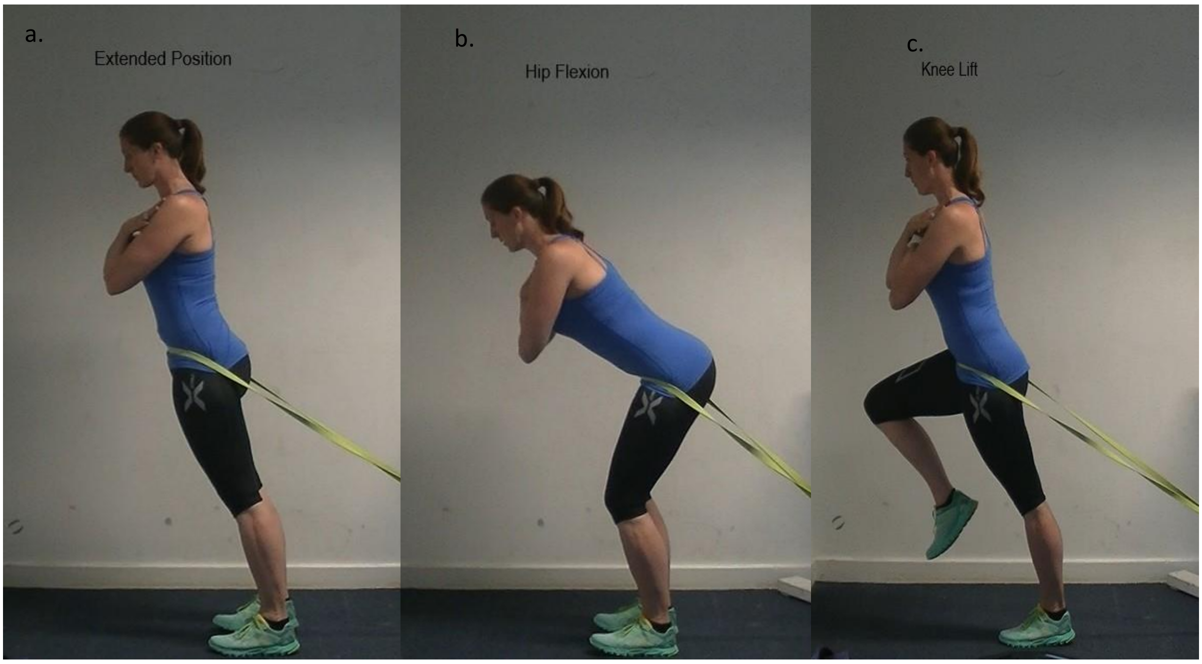


Figure 1. Gluteal focus warm-up protocol using standing resisted hip extension exercise.

- Facing away from anchor point with feet hip width apart. Lean forward from the ankles, against the band, hands crossed and resting on shoulders (a).
- Rock weight back onto heels pushing the hips back as if searching for a chair (b).
- Extend hips dynamically to return to staring position (a). Repeat in a continuous cycle for 60 seconds.
- Then, alternately lift and lower each leg as if sprinting, getting the knee high and forcefully driving foot back down to the ground. Hip extension and forward lean should be maintained through supporting leg (c).
- After 30 seconds, step out of the band.

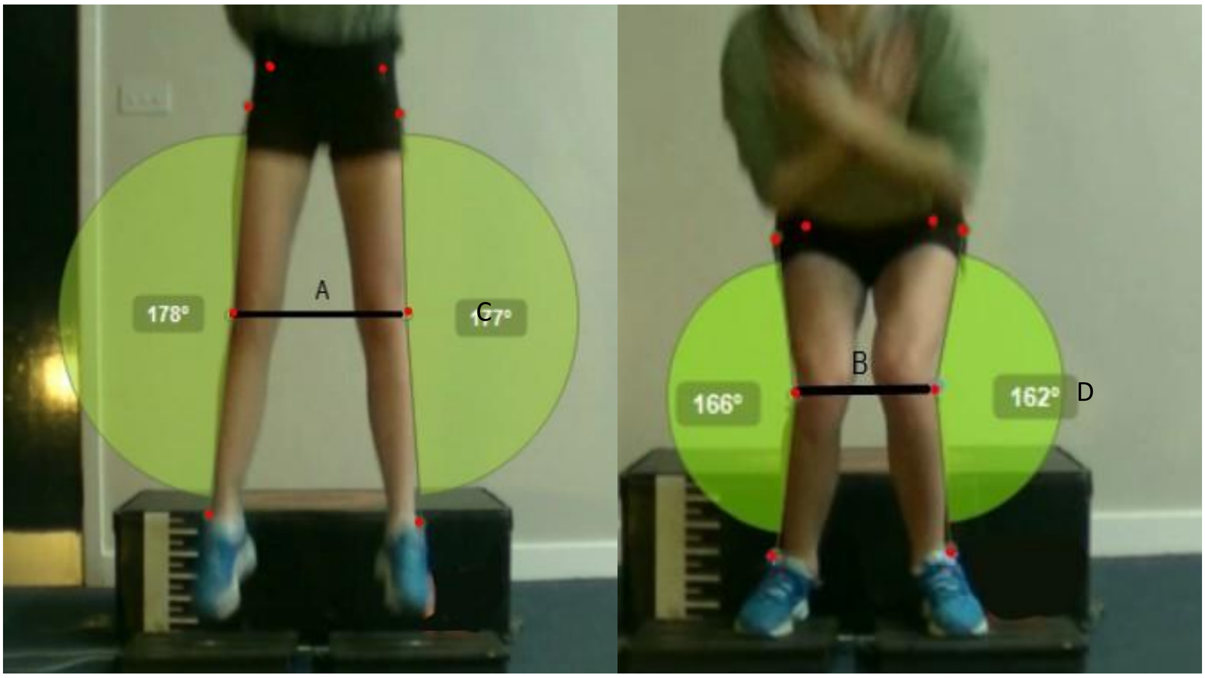
* In initial standing position, if hamstrings or calves can be felt, reposition band slightly upwards or downwards until participant no longer feels them and they feel gluteals starting to fire.

Both warm ups were followed by 90 seconds to 2 minutes break during which time participants were weighed on the force platforms.

Three drop landings and three countermovement jumps were then carried out. During CMJs participants were instructed to jump as high as possible but no technical coaching was given. If at any point a participant missed the platform they repeated that particular trial. In drop landings the instruction was to step forward and land on both feet without jumping from the platform. In both tasks, participants were asked to land naturally.

After data collection, .MTS video files were converted to .AVI ready for analysis in Kinovea. Using a combination of auto-tracking points and manual frame by frame analysis, the maximum valgus distance was calculated by measuring lateral epicondyle to lateral epicondyle and by comparing it to the unloaded measurement between the same two points. Unloaded measurement was taken on the final frame before contact as the aim is to examine the amount of valgus excursion from that position required to absorb a landing or during take-off. Knee angle alteration in degrees was also calculated by using the goniometer tool in Kinovea allowing assessment of greatest valgus for a single knee joint. For each participant, a dominant leg in terms of valgus change from unloaded was identified and that was the leg then used for analysis of valgus change in the three tasks (take off, CMJ landing and drop landing) across both warm ups.

Figure 2



a. Unloaded Phase

b. Loaded Phase

Figure 2. Lower limb marker positioning and calculation of knee valgus motion. Distance between lateral knee markers while unloaded (A) and at maximal knee valgus in loading (B). Maximal valgus motion (˚) = D - C.

Jump height was calculated in Microsoft Excel having exported force data files from Spark View.

2.4 Statistical Analysis

IBM SPSS Statistics (V.24; International Business Machines, Armonk, NY, USA) was used for statistical analysis. To assess for a main effect of either warm up or mobility level on jump height, a repeated measures ANOVA was carried out giving the opportunity to look at any interaction between the two independent variables. Repeated measures ANOVA was also used to assess the effect of warm up and mobility on maximal valgus knee motion in the three tasks. Assessment of the data sets passed tests for normality but sphericity was violated Huynh-Feld corrections were used to interpret the results.

CHAPTER 3

RESULTS

Table 3 describes the jump height outcomes for the two warm-ups and mobility classes as well as the sample as a whole.

Table 3:

Mean Jump Heights Following Dynamic and Gluteal Warm-ups.

Mobility	n	Dynamic		Glute		All	
		cm (±SD)	95% CI	cm (±SD)	95% CI	cm	95% CI
Non-hypermobile	14	22.76 (4.45)	[20.11, 25.41]	22.05 (3.67)	[19.83, 24.27]	22.40 (4.02)	[20.06,24.75]
Hypermobile	9	22.13 (5.26)	[18.82, 25.44]	21.60 (4.45)	[18.84, 24.36]	21.86 (4.73)	{18.94, 24.8]
All	23	22.51 (4.67)	[20.55, 24.83]	21.87 (3.90)	[19.89, 23.53]		

Table 3. Mean jump heights recorded after dynamic, and gluteal warm-ups displayed by mobility and overall sample.

Overall, the dynamic warm-up elicited a higher average jump height than the gluteal focussed warm-up and non-hypermobile participants jumped higher on average than those categorised as hypermobile. Within each mobility category, the spread of results relating to the gluteal warm-up was narrower, with the dynamic warm-up creating greater variability across the sample as shown by larger standard deviations from the mean and wider confidence intervals. The results of the ANOVA test showed there was no significant effect of warm up or mobility on jump height, $F(1,19) = 4.316$, n.s. and $F(1,19) = .048$, n.s. respectively. There was also no statistically significant interaction between the two factors, $F(1,19) = .317$, n.s.

Repeated measures ANOVA showed that there was no main effect on maximum knee valgus response by warm-up, task or mobility, $F(1,19) = .956$, n.s., $F(1,38) = .807$, n.s., and $F(1.19) = .008$, n.s. respectively. However, a three-way interaction was indicated between the variables, $F(1,19) = 4.814$, $p = 0.41$. Effect size was 0.2 with observed power .549 at an α level .05. Closer inspection indicates that the interaction occurred in the non-hypermobile group between warm-up and task. Figure 3 shows the affected task was CMJ take-off (CMJ t-o) where a pronounced decrease in maximum valgus motion occurred after gluteal warm-up, in comparison to the dynamic warm-up and was not replicated in the hypermobile group.

Figure 3:

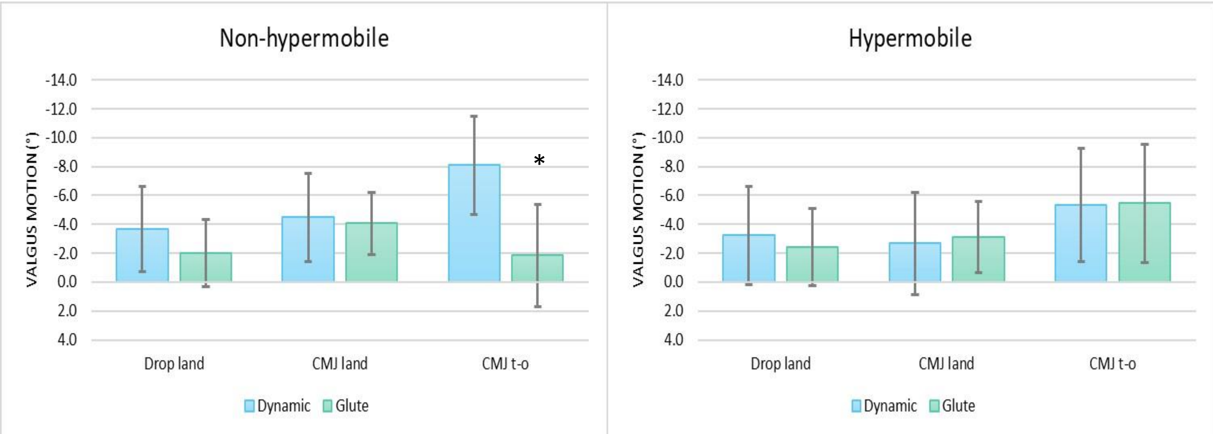


Figure 3. Maximum knee valgus response to task and warm-up separated by mobility. Error bars represent standard error of the mean. Negative numbers indicate more valgus motion. Positive numbers indicate varus motion. * Non-hypermobile participants showed a reduced valgus motion during CMJ take-off following gluteal warm-up, $F(1,19) = 4.814$, $p = 0.41$, α.05.

Table 4 shows in greater detail, means of the maximum valgus motion for the different tasks and their associated confidence intervals. The larger difference in between mean valgus motion during take-off in the non-hypermobile group following the two different warm-ups (-8.08˚, 95% CI [-15.18, -0.99] in comparison to -1.83˚, 95% CI [-9.20, 5.54] following dynamic and gluteal warm-up respectively) is still characterised by overlapping CIs.

Table 4:

Mobility	Warm-up	Task	Mean **Valgus ˚ (±SE)**	95% CI
Non-Hypermobile	Dynamic	Drop land	-3.67 (2.96)	[-9.87, 2.54]
		CMJ land	-4.50 (3.05)	[,1.88]
		CMJ t-o	-8.08 (3.39) *	[-15.18, -0.99]**
	Glute	Drop land	-2.00 (2.31)	[-6.83, 2.83]
		CMJ land	-4.08 (2.15)	[-8.59, 0.42]
		CMJ t-o	-1.83 (3.52)*	[-9.20, 5.54]**
Hypermobile	Dynamic	Drop land	-3.22 (3.42)	[-10.39, 3.94]
		CMJ land	-2.67 (3.52)	[-10.04, 4.70]
		CMJ t-o	-5.33 (3.91)	[-13.52, 2.86]
	Glute	Drop land	-2.44 (2.66)	[-8.02, 3.13]
		CMJ land	-3.11 (2.48)	[-8.31, 2.09]
		CMJ t-o	-5.44 (4.07)	[-13.95, 3.06]

Table 4. Mean maximum valgus response to different tasks following dynamic and gluteal warm-up.

* Take-off during CMJ showed significant decrease in maximum valgus motion after gluteal warm-up, $p<.05$, yet confidence intervals remain overlapped**.

CHAPTER 4

DISCUSSION

4.1 Overall findings

It is known that the gluteal muscles play an important role in both the production of explosive extension forces in jumping and in the stabilisation of the knee in both jumping and landing. Gluteal weakness has previously been implicated in excessive knee valgus motion which has in turn been implicated in ACL injury. Due to the limitations of longer low load gluteal activation warm ups (5,22), especially in terms of the need for extended rest periods before sporting activities are enhanced, this study sought to assess a resisted hip extension warm up to provide gluteal activation in a very short timeframe with little rest. The primary finding, that this intervention warm up has no different effect on jump performance or landing and take-off kinematics than a longer traditional warm up is still of interest. Identifying a warm up protocol as short as the one involved here that performs equally as well as one that take three times the length of time, brings to our awareness a potential protocol that could be utilised in schools and sports teams everywhere. By finding something of equal measure to traditional warm ups, this study offers a potential solution to athletes needing to become 'performance ready' in a matter of seconds. This could well benefit those involved in court and pitch sports such as netball, basketball, rugby and hockey where bench substitutes need to get ready quickly. The effect on the cardiovascular system and muscle temperature was not assessed here, therefore other elements of warm-up will likely still need to be considered.

4.2 Task relevance in warm-up

In terms of the lack of effect of warm up on knee valgus motion, it may be in part attributed to the type of movement involved in the warm-up. The main motion of the warm-up is flexion and extension in the sagittal plane which potentially plays a larger role in activating gluteus maximus than gluteus medius. The small improvements in external hip rotation and reduced valgus reported following low load gluteal activation (22) may be attributable to the fact that the protocol involved more hip abduction and external rotation movements potentially providing a larger stimulus to the muscles involved in mediating against excessive knee valgus. Going forward, it would be interesting to investigate the effect of the addition of a resistance band placed around the outside of the knee during the initial bilateral flexion-extension movement to see if it could provide an external rotation stimulus whilst keeping load and fatigue relatively low.

4.3 Statistical interpretation and limitations

The author would be very cautious to read too greatly into the three-way interaction between warm up, task and mobility in terms of knee valgus ($F(1,19) = 4.814$, $p = 0.41$). Despite a noticeable reduction in knee valgus during take-off after the gluteal warm up among non-hypermobile participants, $p < .05$ and an effect size of only 0.2 with observed power .549 at an α level .05, it would be incorrect to assume that the gluteal warm-up reduces valgus motion in all non-hypermobiles. Smaller estimated effect sizes tend to require larger sample sizes to achieve statistical power. This has been a problem for this study due to the high number of participants not being able to complete the study and is evident in the very low power value of .549. Even with greater power, effect sizes in strength and conditioning have been reported as trivial at <0.25, small at 0.25-0.5, moderate at 0.5-1.0 and large at >1. Lower and upper bounds for 95% CI all remain overlapped throughout all permutations of the study which suggests variation is too large to consider the result noteworthy. A sample size of some 35 participants would have been required to offer statistical power to these findings.

4.4 Methodolical considerations

A limitation of the current study is the use of 2D video analysis. Much of the research guiding our developing knowledge is now coming from studies using 3D motion capture systems. Whilst 2D analysis has been well documented as a robust and reliable means of processing information there are some drawbacks to its use which potentially leave us open to making incorrect assumptions. 3D analysis is able to build a more coherent picture of what is happening at the various joints of the lower limb while in coronal plane only, differences between internal and external rotation cannot be easily quantified. In the present study, manual frame by frame tracking had to be done on a number of occasions where an element of limb rotation would move the lateral epicondyle marker out of view, rendering the tracking software redundant. It is however, an easily usable tool that coaches and athletes alike can all use with very little expensive equipment needed. As such, in the context of screening for excessive valgus motion in young athletes, this method still has value, but cannot hope to provide in depth detail of the lower limb mechanics as a whole. The use of a single leg measurement of valgus was based on previous literature in that demonstrates girls tend to have one leg that is dominant in carrying out most of the valgus motion. This was very evident in the study, and identifying the leg in question for each participant was simple in all but a few cases; most participants had a great deal of valgus on one side only and often tended toward varus motion on the other. This trait, that is more common in girls, is another thing that 2D video analysis could easily be used to assess for.

The largest valgus angles tended to occur during take off rather than landing. This is likely due to the difficulty in coordinating the deceleration and force absorption prior to change of direction followed by rapid force production needed for take-off whilst also maintaining joint stability. However, many studies focus on simple landing tasks rather than more complex take-off manoeuvres and at this time, it is unclear whether the high forces involved in landing, or the increased valgus motion during take-off provides a larger injury risk. Going forward the author believes it would be of interest and benefit to see more investigation using both force platform data, 3D analysis and modelling techniques into take-off activities as well as landing.

4.5 Practical applications

The short gluteal warm up described in this study may provide an ideal pitch-side warm up for bench substitutes preparing to join play. Athletes have limited warm up opportunity and this is certainly worthy of trial against traditional, more time consuming dynamic warm ups.

The use of 2D analysis can easily identify leg dominance for knee valgus in female athletes and this assessment may be of use in routine screening identify potential injury risk factors.

CHAPTER 5

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APPENDIX

A. Ethics Application Form

Ethics Application Form

1) Name of proposer(s)	Alison Knowles
2) St Mary's email address	135267@live.smuc.ac.uk
3) Name of supervisor	Daniel Cleather

4) Title of project

Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?

5) School or service	School of Sport, Health and Applied Sciences
6) Programme (whether undergraduate, postgraduate taught or postgraduate research)	Postgraduate taught

7) Type of activity/research (staff/undergraduate	Postgraduate student

8) Confidentiality	
Will all information remain confidential in line with the Data Protection Act 1998?	YES

9) Consent	
Will written informed consent be obtained from all participants/participants' representatives?	YES

10) Pre-approved protocol	
Has the protocol been approved by the Ethics Sub-Committee under a generic application?	NO Date of approval:

11) Approval from another Ethics Committee	
a) Will the research require approval by an ethics committee external to St Mary's University?	NO
b) Are you working with persons under 18 years of age or vulnerable adults?	YES

12) Identifiable risks	
a) Is there significant potential for physical or psychological discomfort, harm, stress or burden to participants?	NO
b) Are participants over 65 years of age?	NO

c) Do participants have limited ability to give voluntary consent? This could include cognitively impaired persons, prisoners, persons with a chronic physical or mental condition, or those who live in or are connected to an institutional environment.	NO
d) Are any invasive techniques involved? And/or the collection of body fluids or tissue?	NO
e) Is an extensive degree of exercise or physical exertion involved?	NO
f) Is there manipulation of cognitive or affective human responses which could cause stress or anxiety?	NO
g) Are drugs or other substances (including liquid and food additives) to be administered?	NO
h) Will deception of participants be used in a way which might cause distress, or might reasonably affect their willingness to participate in the research? For example, misleading participants on the purpose of the research, by giving them false information.	NO
i) Will highly personal, intimate or other private and confidential information be sought? For example sexual preferences.	NO
j) Will payment be made to participants? This can include costs for expenses or time.	NO If yes, please provide details
k) Could the relationship between the researcher/ supervisor and the participant be such that a participant might feel pressurised to take part?	NO
l) Are you working under the remit of the Human Tissue Act 2004?	NO

13)Proposed start and completion date

Please indicate:

- When the study is due to commence.
- Timetable for data collection.
- The expected date of completion.

Please ensure that your start date is at least 4 weeks after the submission deadline for the Ethics Sub-Committee meeting.

Data collection: 11-16 February 2018
Additional available collection time: Week commencing 26^{th} February 2018
Expected date of completion of data collection: 2^{nd} March 2018

14)Sponsors/Collaborators

Please give names and details of sponsors or collaborators on the project. This does not include your supervisor(s) or St Mary's University.

- Sponsor: An individual or organisation who provides financial resources or some other support for a project.

- Collaborator: An individual or organisation who works on the project as a recognised contributor by providing advice, data or another form of support.

None

15. Other Research Ethics Committee Approval

- Please indicate whether additional approval is required or has already been obtained (e.g. an NHS Research Ethics Committee).
- Please also note which code of practice / professional body you have consulted for your project.
- Whether approval has previously been given for any element of this research by the University Ethics Sub-Committee.

N/A

16. Purpose of the study

In lay language, please provide a brief introduction to the background and rationale for

your study. [100 word limit]

It is estimated that up to 50% of adolescent girls have Generalised Joint Hypermobility (GJH) or are excessively flexible). GJH is associated with higher risk of knee injury.
Adolescent girls are active in sports such as netball involving jumping and landing activities, also associated with increased risk of knee and ankle injury. This research aims to assess whether excessive joint movement can be acutely altered during landing and jumping tasks by use of a short gluteal muscle warm up activity. This could have beneficial implications to warm-up protocols for adolescents with GJH going forward.

17. Study Design/Methodology

In lay language, please provide details of:

a) The design of the study (qualitative/quantitative questionnaires etc.)
b) The proposed methods of data collection (what you will do, how you will do this and the nature of tests).
c) You should also include details regarding the requirement of the participant i.e. the extent of their commitment and the length of time they will be required to attend testing.
d) Please include details of where the research/testing will take place, including country.
e) Please state whether the materials/procedures you are using are original, or the intellectual property of a third party. If the materials/procedures are original, please describe any pre-testing you have done or will do to ensure that they are effective.

This study involves collecting both qualitative and quantitative data on participants. It will take place at Pangbourne College, Berkshire, UK. Participants will take part in two 20 minute sessions where they will participate in a warm up and jump test.

Method:
Once participants have been identified and parental consent and participant assent obtained, participants will be formally accepted onto the study.

Testing space set-up:
Room: To be allocated but likely to be sports hall or sports classroom. Both are warm, well lit, can be screened from view from passers-by and have sufficient head room and suitable flooring to carry out drop jump activities.

Warm up area:
Will contain a static bike and sufficient floor space to carry out dynamic warm up activities.
Power band will be attached to the wall at an anchor point.

Jump testing area:
30cm high box will be set out with force platform on the ground in front of it.
Sufficient room in front and beside will be left to set up video cameras.
Box position will be marked on the floor at all corners to ensure that if it is knocked out of place it can be returned.

Camera tripods will be set up and cameras triangulated calibrated as per instructions on St Mary's biomechanics 2D video analysis tutorial. This will require use of tape measures, marker cones, and a second person to help.
Temperature will be checked and recorded to assure consistency across testing sessions.
Testing will be shielded from view from passers-by by using curtains in PE classroom or cricket nets if using sports hall.

Testing Sessions: Session 1:
1) a PARQ will be issued to and collected from each participant to ensure readiness and suitability for testing.
All participants will then be allocated a number to attach to their data so that their personal identity is not linked to their raw data scores in analysis software. The researcher will keep the key to the identities so that data can be identified for removal in the event of a participant withdrawing from the study or requesting their data.
2) Participants will be randomly allocated to group one or group two – Group one will do the control trial first. Group two will do the intervention trial first.
A simple randomisation plan will be created using the website randomization.com. The number of participants and conditions will be specified in the 'second generator' which is used to create random plans when each participant is due to carry out both/all conditions in a random order. Conditions will be 'normal' and 'glute'. The generator creates a list with the order in which the two conditions will be tested for each participant number. The first combination on the list relates to participant number 1, the second to participant number 2, and so on. All those with 'normal' first will be group 1 and all those with 'glute' first will be in group 2.
3) Researcher will collect qualitative data about joint mobility via the Modified 9 point Beighton test. This will allow each participant to be categorised as

hypermobile or non-hypermobile.
4) Participant will carry out control trial if in group one or intervention trial if in group two.
5) Once data is collected, participant will be thanked and told when their second jump trial session is to take place.

Session 2:
Participants will be asked if there has been any change in their ability and readiness to take part. If not, then they will be permitted to carry out session 2. Participants from group one will carry out the intervention trail and participants in group two will carry out the control trial.

Trial protocols: Control trial:
1) Participant will be guided through a warm-up consisting of 5 minutes on a static exercise bike and 5 minutes of dynamic warm-up activities.
2) Once warm, participant will have markers stuck to clothing or skin at greater trochanter, ASIS, PSIS, lateral and medial epicondyles of the knees, and lateral and medial malleoli of the ankles to enable accurate tracking of joint angles and speeds from the side and front views.
3) Participant will then perform 3 x drop landings from a 30cm box onto a force plate. A demonstration will be provided. The participant will then perform 3 x countermovement jumps on the force platform. The participant will be encouraged to jump as high as possible but will not be technically coached so that movements are as natural as possible. The landing and jump trials will be recorded on camera to allow later analysis.
4) On completion of testing, equipment will be stored securely and no data left on portable storage.
Intervention trial:
1) Participant will have markers stuck to clothing or skin at lateral and medial epicondyles of knees, and lateral and medial malleoli of ankles to enable accurate tracking of joint angles and speeds from the side and front views. Greater trochanter, ASIS and PSIS markers will be applied after warm up is complete as the resistance band will be likely to disrupt their positioning.
2) Participants will carry out a 5 minute warm-up on the static bike and this time will carry out the resisted hip extension protocol to complete their warm up.
Resisted hip extension warm-up protocol:
- Following a 5 minute bike
- Participants step into the band and face away from the anchor point with the band around their waist. With feet hip width apart, step away from the anchor point until you feel the band pulling you gently back towards the wall.
- Remain still, standing straight and leaning forward, from the ankles only, like a ski-jumper after they have taken off.
- If you feel your glutes firing, stay still. If you feel your calves or hamstrings, gently the move the band slightly up or down until you either feel your glutes starting to fire or you feel nothing.
- With hands crossed in front and resting on the shoulders, rock weight back onto heels and push the hips back as if searching for a chair behind you.
- Extend the hips dynamically again, returning to your ski-jumper position.
- Repeat in a continuous cycle for 60 seconds.
- Then alternately lift and lower one leg as if sprinting, getting the knee high and forcefully driving back down to the ground. After 30 seconds step out of the band.

3) Participant will then perform 3 x drop landings from a 30cm box to a force plate. A demonstration will be provided. The participant will then perform 3 x countermovement jumps on the force platform. The participant will be encouraged to jump as high as possible but will not be technically coached so that movements are as natural as possible. The landing and jump trials will be recorded on camera to allow later analysis.
4) On completion of testing, equipment will be stored securely and no data left on portable storage.
Throughout the study, a second member of staff from the host venue will be present at all times. They will not have access to view the collected data but will be available to help set up equipment, help with warm-up protocols and help deal with any unforeseen circumstances.

18. Participants

Please mention:

a) The number of participants you are recruiting and why. For example, because of their specific age or sex.

b) How they will be recruited and chosen.

c) The inclusion/exclusion criteria.

d) For internet studies please clarify how you will verify the age of the participants.

e) If the research is taking place in a school or organisation then please include their written agreement for the research to be undertaken.

f) Please state any connection you may have with any organisation you are recruiting from, for example, employment.

Participants:

30-40 participants will be recruited to provide the opportunity for meaningful statistical results to be calculated.

Females aged 14-18 years will be recruited as they fit the criteria for high rates of hypermobility and regular participation in jumping and landing sports such as netball. Particpants will be invited from GCSE and A Level PE groups at Pangbourne College. These girls have an interest in sport and activity, are physically fit and active, and have experience of jumping and landing activities from their PE lessons and sports activities – as such they make reliable participants who hopefully will gain something positive from the experience themselves. If additional participants are required, the invitation will extend to female A

Level psychology students who require an understanding of research methods and who would benefit from experiencing research first hand.

Exclusion criteria – current injuries that prevent jumping movements and any who are registered as 'off games' on the Pangbourne College Health Centre register.

I work at Pangbourne College as a sports coach and boarding assistant so the majority of the pupils who will be invited to partake will know me to some extent. It will be made clear that there is no pressure to partake in the study and there will always be another member of College staff present.

19. Consent
If you have any exclusion criteria, please ensure that your Consent Form and Participant Information Sheet clearly makes participants aware that their data may or may not be used. a) Are there any incentives/pressures which may make it difficult for participants to refuse to take part? If so, explain and clarify why this needs to be done b) Will any of the participants be from any of the following groups? ➢ Children under 18 ➢ Participants with learning disabilities ☐ Participants suffering from dementia ☐ Other vulnerable groups. c) If any of the above apply, does the researcher/investigator hold a current DBS certificate undertaken within the last 3 years? A copy of the DBS must be supplied separately from the application. How will consent be obtained? This includes consent from all necessary persons i.e. participants and parents.
a) No. b) The majority of participants will be under 18. c) Researcher holds Enhanced DBS for Pangbourne College which has been checked and logged at St Mary's on 29.11.2017 d) All willing participants will have parental consent letters sent to their parents/guardians and once this consent is obtained, will also sign letters of participant assent.

20. Risks and benefits of research/ activity
a) Are there any potential risks or adverse effects (e.g. injury, pain, discomfort, distress, changes to lifestyle) associated with this study? If so please provide details, including information on how these will be minimised. b) Please explain where the risks / effects may arise from (and why), so that it is clear why the risks / effects will be difficult to completely eliminate or minimise. c) Do you have an approved risk assessment form relating to this research? d) Does the study involve any invasive procedures? If so, please confirm that the researchers or collaborators have appropriate training and are competent to deliver these procedures. Please note that invasive procedures also include the use of deceptive procedures in order to obtain information. e) Will individual/group interviews/questionnaires include anything that may be sensitive or upsetting? If so, please clarify why this information is necessary (and if applicable, any prior use of the questionnaire/interview). f) Please describe how you would deal with any adverse reactions participants might experience. Discuss any adverse reaction that might occur and the actions that will be taken in response by you, your supervisor or some third party (explain why a third party is being used for this purpose). g) Are there any benefits to the participant or for the organisation taking part in the research?

a and b) Very minimal risk of pain or discomfort in knee and ankle joint during landing tasks. This is no greater risk than encountered during participants' netball matches or
sports sessions to which they are accustomed. All landings in this study are two footed reducing load on any one joint and the number of repetitions is being kept to a minimum (three trials) to keep risk as low as possible. Any participant reporting pain or discomfort will be stopped immediately.

c) This study has an approved risk assessment.
d) This study does not involve invasive procedures
e) N/A
f) Pain or discomfort e.g. aching knees, joint discomfort – immediate stop of trial, if discomfort persists after stopping refer to health centre. Log and follow up with participant.
   In situations where adverse reaction is not severe, a second member of College staff may take a participant to health centre in place of main researcher.
   Any unexpected injury e.g. ankle sprain – immediate stop of trial, treat participant as casualty as per any sporting first aid situation (researcher is Pitch Side Sports First Aid trained and research area has fully stocked first aid kit). Inform College health centre staff and escort to health centre for assessment. Log injury with the host College. Follow up with participant after assessment. Complete relevant reporting form (accident, medical emergency or near miss) found on University H&S portal page, and pass to the Technical Services team for processing.

g) Participants gain insight to the running of sports related research which is likely to be of interest to them. Participants will also be given the opportunity to look at an overview of their individual results and movement patterns after the study is completed which may be of use to them in their sports training going forward. A presentation of findings will be offered to all participants.

21. Confidentiality, privacy and data protection

• What steps will be taken to ensure participants' confidentiality?

• Please describe how data, particularly personal information, will be stored (please state that all electronic data will be stored on St Mary's University servers).
• If there is a possibility of publication, please state that you will keep the data for a period of 10 years.
• Consider how you will identify participants who request their data be withdrawn, such that you can still maintain the confidentiality of theirs and others' data.

• Describe how you will manage data using a data a management plan.

• You should show how you plan to store the data securely and select the data that will be made publically available once the project has ended.

• You should also show how you will take account of the relevant legislation including that relating data protection, freedom of information and intellectual property.
Who will have access to the data? Please identify all persons who will have access to the data (normally yourself and your supervisor).

• Will the data results include information which may identify people or places?

• Explain what information will be identifiable.
• Whether the persons or places (e.g. organisations) are aware of this.
• Consent forms should state what information will be identifiable and any likely outputs which will use the information e.g. dissertations, theses and any future publications/presentations.

Participants' personal information will be kept secure and confidential in line with the Data Protection Act 1998. The main researcher and supervisor will be the only people with access to this information.
Researcher will partially anonymise data by way of allocating a number to each participant so that their trial data will not have a name with it. A key will be kept securely so that, in the event of a participant wishing to withdraw or access their personal information, the main researcher is able to go back and identify it.
Only the main researcher and their supervisor will have access to data. Facial features will be blanked out and any other identifiable clothing made indistinguishable in the event of using an image in the writing up of the research. No participant's image will be used without prior consent.
All electronic data files will be securely stored on St Mary's University servers.
No data will be kept on portable storage such as memory cards beyond the time needed to collect and transfer to safe storage.
Paper PAR-Q and consent forms will be scanned and transferred to St Mary's servers and originals kept in secure locked storage by the main researcher until they can be disposed of by secure shredding service.
The place of research will not be identifiable in the write up of this research. In the event of publication, data will be kept for 10 years.

22. Feedback to participants

Please give details of how feedback will be given to participants:

• As a minimum, it would normally be expected for feedback to be offered to participants in an acceptable to format, e.g. a summary of findings appropriately written.
• Please state whether you intend to provide feedback to any other individual(s) or organisation(s) and what form this would take.

A presentation of overall findings will be offered to the participants and the host organisation's sports department.
Individual participants will be offered their individual results with respect to their mobility screening result and their overall response to the tested warm-up

variables in terms of both jump performance and joint response.
The proposer recognises their responsibility in carrying out the project in accordance with the University's Ethical Guidelines and will ensure that any person(s) assisting in the research/ teaching are also bound by these. The Ethics Sub-Committee must be notified of, and approve, any deviation from the information provided on this form.

Signature of Proposer(s)	Date: 05/12/17
Signature of Supervisor (for student research projects)	Date: 05/12/17

B. Ethical Approval Sheet

St Mary's University Twickenham London

Approval Sheet

Name of applicant:

Alison Knowles Name

of supervisor: Daniel

Cleather

Programme of study: MSc Strength and Conditioning

Title of project: Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?

Supervisors, please complete section 1 or 2. If approved at level 1, please forward a copy of this Approval Sheet to the School Ethics Representative for their records.

SECTION 1

Approved at Level 1

Signature of supervisor (for student

applications)...

Date..

....

SECTION 2

Refer to School Ethics Representative for consideration at Level 2 or Level 3

Signature of supervisor.......... ....

Date...05/12/17..

SECTION 3

To be completed by School

Ethics Representative Approved

at Level 2

Signature of School Ethics Representative..

Date...

SECTION 4

To be completed by School Ethics Representative.

Level 3 consideration is required by the Ethics Sub-Committee.

Signature of School Ethics Representative....**See approval letter**

……………….....................

Date...

....

Level 3 approval – confirmation will be via correspondence from the Ethics Sub-Committee

C. Ethical Approval Letter

St Mary's University Twickenham London

17 January 2018 SMEC_2017-18_047

Alison Knowles (SHAS): 'Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile aadolescent females?'

Dear Alison

University Ethics Sub-Committee

Thank you for re-submitting your ethics application for consideration.

I can confirm that all required amendments have been made and that you therefore have ethical approval to undertake your research.

Yours sincerely

Prof Conor Gissane
Chair, Ethics Sub-Committee

Cc Daniel Cleather

D. Participant Information Sheet

Participant Information Sheet

St Mary's University Twickenham London

Part 1: Project Outline

Title of Project: Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?

Researcher: Alison Knowles

Purpose of the study: To investigate the effects of a gluteal (bottom) muscle warm-up on jumping and landing in teenage girls. As many as 50% of teenage girls are thought to have hypermobile (very flexible) joints, and it is thought that this can increase the likelihood of getting some sports injuries for example knee and ankle sprains. This research aims to investigate whether specific glute warm-up can reduce the negative effects of hypermobility on jumping and landing.

This research is part of my MSc in Strength and Conditioning at St Mary's University, Twickenham. The results of this research will be written up as part of my dissertation and may be submitted for publication if considered noteworthy.

Further information can be obtained from myself and my supervisor, Daniel Cleather.
Email for Alison Knowles: 135267@live.smuc.ac.uk
Email for Daniel Cleather: Daniel.Cleather@stmarys.ac.uk

Part 2: Your participation in this project.

Why you? You have been invited to take part as you are a female between the age of 14 and 18 years old putting you into the category that I am interested in learning more about. As a PE or Psychology student, you are likely to be interested in sports and/or human research so I hope it will be of interest to you.
There is no pressure to take part in this research and if you do agree to take part, you can withdraw at any time. If you want to withdraw from the study, all you need to do is fill in the form at the bottom of your consent form and give it to me.

What does this involve? If you take part, once I have your consent form and a confirmation that you are fit and able to take part (a PARQ) you will take part in two short sessions. The trials in each session will be the same but the warm-up will differ. One session will involve a standard warm-up and the other, a gluteal muscle focus that involves working against a resistance band to encourage the muscles to become more active.

Session 1: The first session will involve a quick test of your mobility – this involves looking at how much movement you have in your hands, arms, legs and back. It takes less than two minutes and does not involve any contact.
Following this, a warm up will be carried out followed by three drop landings and then three countermovement jumps. Drop landings involve stepping off a low box and landing on two feet. Countermovement jumps involve a small squat movement which is followed immediately by jumping in the air.

Session 2: The second session involves the same three landings and jumps, with the second type of warm up.

What is being measured and what will happen to the information? During each set of jumps, a video camera records you from the front and the side. The platform that you jump on will measure the forces that you are creating and dealing with as well as helping to show how high and how quickly you jump. The video data will be used to measure the angles between your hips and knees and ankles and when combined with the force data, I can look to see if changing the warm up changes the way you jump and land and whether it has potential to improve how you warm up for sports and activities.

Privacy: Your information will always be kept safe in line with Data Protection law. Only my supervisor and I can look at the original video data. Your name will never be used in any write up or report, nor will your face be visible in any images used to report the results of this research. **You can ask me at any time to take your individual data out of the study.**

Are there any risks? No more than in your normal sporting activities. If you have questions or are unsure, please ask me.

How long will this take? The two sessions will take no more than 20 minutes each. They will not adversely affect your academic or sporting performance.

What do I get from it? Aside from the first-hand experience of taking part in research, you will have the opportunity to go through your personal outcomes after the study is complete. This will include the results of your mobility screening and the overall result of your jump performances following a standard warm-up and a gluteal focused warm-up. The results of the research will be presented to all those involved at the end of the process.

YOU WILL BE GIVEN A COPY OF THIS SHEET TO KEEP TOGETHER WITH YOUR CONSENT FORM

E. Parent Information Sheet

Information sheet for parents

St Mary's
University
Twickenham
London

Part 1: Project Outline

Title of Project: Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?

Researcher: Alison Knowles

Purpose of the study: To investigate the effects of a gluteal muscle warm-up on jumping and landing in teenage girls. As many as 50% of teenage girls are thought to have hypermobile joints, and it is thought that this can increase the likelihood of getting some sports injuries for example knee and ankle sprains. This research aims to investigate whether a specific gluteal warm-up can reduce the negative effects of hypermobility on jumping and landing and generally improve performance.

This research is part of my MSc in Strength and Conditioning at St Mary's University, Twickenham. The results of this research will be written up as part of my dissertation and may be submitted for publication if considered noteworthy.

Further information can be obtained from me and my supervisor, Daniel Cleather.
Email for Alison Knowles: 135267@live.smuc.ac.uk
Email for Daniel Cleather: Daniel.Cleather@stmarys.ac.uk

Part 2: Your daughter's participation in this project.

Why has your daughter been invited to participate? Your daughter has been invited to take part as she falls into the category that I am interested in learning more about - female between the age of 14 and 18 years of age. I have invited students of PE and/or psychology as I feel they are likely to be interested in sports and/or human research so I hope it will be a learning opportunity for them that will be of interest.

There is no pressure for your daughter to take part in this research and she can withdraw at any time without prejudice. If you want to withdraw your daughter from the study, all you need to do is fill in the form at the bottom of your consent form and give it to me.

What does this research involve? All testing will take place at Pangbourne College. If your daughter takes part, once I have your consent form and a confirmation that your daughter is fit and able to take part (a PARQ questionnaire will be used to assess this) there will be two short sessions. The trials in each session will be the same but the warm-up will differ. One session will involve a standard warm-up and the other, a gluteal muscle focus that involves working against a resistance band to encourage the muscles to become more active.

Session 1: The first session will involve a quick test of mobility – this involves looking at how much movement your daughter has in her hands, arms, legs and back. It takes less than two minutes and does not involve any contact. Following this, a warm up will be carried out and followed by performing three drop landings and then three countermovement jumps. Drop landings involve stepping off a low box and landing on two feet. Countermovement jumps involve a small squat movement which is followed immediately by jumping in the air.
Session 2: The second session involves the same three landings and jumps, with the second type of warm up.

What is being measured and what will happen to the information? During each set of landings and jumps, a video camera records from the front and the side. A force platform will measure the forces that are being absorbed in the landings and created in the jumps as well as showing jump height. The video data will be used to measure the angles between the hips and knees and ankles and, when combined with the force data, I can look to see if changing the warm up changes the way in which girls land and jump and whether it has the potential to improve how we warm up for sports and activities.

Privacy: Your and your daughter's information will always be kept safe in line with Data Protection law. Only my supervisor and I can look at the original video data. Your daughter's name will never be used in any write up or report, nor will her face be visible in any images used to report the results of this research. **You can ask me at any time to take your daughter's individual data out of the study.**

Are there any risks? All the landings and jumps are two footed and there is no greater risk than in normal sporting activities. If you have questions or are unsure, please ask me.

How long will this take? The two sessions will take no more than 20 minutes each. They will not adversely affect your daughter's academic or sporting performance.

What does your daughter get from it? Aside from the first-hand experience of taking part in research, your daughter will have the opportunity to go through her personal outcomes after the study is complete. This will include the results of her mobility screening and the overall result of her jump performances following a standard warm-up and a gluteal focused warm-up. The overall results of the research will be presented to all those involved at the end of the process.
I hope that the results will allow me to contribute to our understanding of how adolescent girls move and whether it is possible to alter how we use warm-ups for sports activities to reduce the risk of injury for this population.

YOU WILL BE GIVEN A COPY OF THIS SHEET TO KEEP TOGETHER WITH YOUR CONSENT FORM

F. Participant Assent Form

St Mary's University Twickenham London

Name of Participant: ____

Title of Project: Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?

Main Researcher and contact details: Alison Knowles 135267@live.smuc.ac.uk

Members of the research team: Alison Knowles, Daniel Cleather

1. I agree to take part in the above research. I have read the participant information sheet which is attached to this form. I understand my role in this research and all of my questions have been answered to my satisfaction.
2. I understand that I am free to withdraw at any time before and during the study for any reason and without prejudice.
3. I have been informed that the confidentiality of the information I provide will be safeguarded.
4. I am free to ask questions at any time before and during the study.
5. I understand that if I have an injury that affects my ability to complete the research task then I will not be able to participate, and in the event of becoming injured during the time course of the research I will inform the lead researcher and my data will not be used.
6. I have been provided with a copy of this form and the Participant Information Sheet.

Data Protection: I agree to the university processing the personal data which I have supplied. I agree to the processing of such data for any purposes connected with the research project as outlined to me.

Name of participant (print)____

Signed____________________________________Date ___________________

If you wish to withdraw from the research, please complete the form below and return to Alison Knowles

Title of project: Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?

✂………………………………………………………………………………………………………
…

I WISH TO WITHDRAW FROM THIS STUDY

Name (print): ______________________________________
Signed:____Date: __

G. Parental Consent Form

St Mary's
University
Twickenham
London

Name of Participant: ____

Title of Project: Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?

Main Researcher and contact details: Alison Knowles

135267@live.smuc.ac.uk Members of the research team: Alison

Knowles, Daniel Cleather

1. I agree to my child taking part in the above research. I have read the participant information sheet which is attached to this form. I understand my child's role in this research and all of my questions have been answered to my satisfaction.
2. I understand that I am free to withdraw my child at any time before and during the study for any reason and without prejudice.
3. I have been informed that the confidentiality of the information I and my child provide will be safeguarded.
4. I am free to ask questions at any time before and during the study.
5. I have been provided with a copy of this form and the Participant Information Sheet.

Data Protection: I agree to the university processing the personal data which I and my child have supplied. I agree to the processing of such data for any purposes connected with the research project as outlined to me.

Name of parent (print)______________________

Signed (parent)
__________________________Date_______________________________

If you wish to withdraw your child from the research, please complete the form below and return to Alison Knowles
Title of project: Can gluteal warm-up acutely affect lower limb joint mechanics during landing and jumping tasks in hypermobile and non-hypermobile adolescent females?
✂……………………………………………………………………………………………

I WISH TO WITHDRAW MY CHILD FROM THIS STUDY

Parent Name (print):_______________________Relating to (participant)
____

Signed:_________________________________Date:_______________________