Sammendrag

Bakgrunn: Konseptet kjernestabilitet og balanse er vektlagt under basistreningen til norske skihoppere. Forestillingen av hvor viktig det kan være for idrettsprestasjon har lenge vært et interessant område innen forskning. Formålet med denne studien var å undersøke forholdet mellom kjernestabilitet, balanse og prestasjonsevne i skihopp blant aktive skihoppere.

Metoder: Elleve mannlige skihoppere ble testet for stødighet i to vanlige kjerneøvelser (planke- og balanseøvelse) innenfor skihoppmiljøet. Prestasjonsevne i skihopp ble rangert av en gruppe erfarne trenere. «Inertial measurement units» ble brukt til å måle akselerasjon og vinkelhastighet, og Oqus-kameraer og «Qualisys Track Manager» programvare ble brukt til å måle segment- og leddvinkler. Prestasjonen fra kjerneøvelsene ble sammenligned med prestasjonsevne i skihopp.

Resultater: Hovedfunnene viser en negativ sammenheng mellom stødigheten av korsryggen (plankeøvelsen), og en positiv sammenheng i bevegelse av albuevinkel (balanseøvelsen) i forhold til prestasjonsevne i skihopp.

Diskusjon og konklusjon: Liten amplitude av bevegelse i korsrygg under plankeøvelsen har en sammenheng med prestasjonsevne i skihopp. Deltakerne hadde noe tekniske ulikheter i utførelse som kan ha påvirket resultatene.

Nøkkelord: Skihopping, kjernestabilitet, balanse, idrettsprestasjon, overførbarhet fra trening

Abstract

Background: The concept of core stability and balance are emphasized during athletic training for Norwegian ski jumpers. The impression of how important it can be for sport performance has long been a matter of interest within research. The purpose of this study was to examine the association between core stability, balance and ski-jumping performance ability in competitive ski jumpers.

Methods: Eleven male ski jumpers were tested for steadiness in two commonly used core exercises (plank and balance exercise) in the ski jump environment. Ski-jumping performance ability was ranked by a group of experienced trainers. Inertial measurement units were used to obtain acceleration and angular velocity, and Oqus cameras and Qualisys Track Manager software were used to determine segment- and joint angles. Performance from the core exercises was compared to ski-jumping performance ability.

Results: The main findings show a negative relationship for the steadiness in the lower back (plank exercise), and a positive relationship for elbow angle movement (balance exercise) with ski-jumping performance ability.

Discussion and conclusion: Small amplitude motion in the lower back during the plank exercise is related to ski-jumping performance ability. The participants had some technical differences in execution, which may have had an impact on the results.

Keywords: Ski jumping, core stability, balance, sport performance, training transfer

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Introduction

Ski jumping is an Olympic sport that can be divided into the following four phases: in-run, take-off, flight, and landing [16]. The movement sequence in ski jumping is complex and affects upper and lower extremities with various conditions. Sport performance is measured by distance and style, and distance is mainly determined by the take-off phase and the flight phase [20]. Controlling the core of the body at the instant of take-off may impact the distance of the flight [13].

The athletic training that athletes practice outside of competition has long been a matter of interest within research [6, 10, 12, 27]. Coaches implement a wide range of exercises to athletes with the intention of improving specific motor abilities or technical skills in sports [6, 10]. There are numerous studies investigating these types of exercises, some of them associating core stability and balance to be important factors for sport performance [27]. It is however a controversial topic that need further investigation. The concept of core stability and balance have been implemented in training programs for many years. The impression of how important it can be for sport performance has been discussed extensively by experts [12, 27].

Core stability is a term frequently used in sport science to describe an ability to control trunk movements [8]. It contains two terms that further consists of several variations. The term 'core' is used to describe muscles and tissue associated with the trunk region and shoulder girdle [5, 15, 18, 24]. 'Stability' is used in sport science to describe an ability to maintain control of a given position or posture [8]. However, the term stability has its origin from physics (i.e. stable equilibrium) and refers to a state or situation at rest that restores to the same state if acted upon by a destabilising force [25]. The application of stability in sport science may cause confusion among some readers, as it conflicts with the original terminology. The upright stance is an example of human posture being in an unstable equilibrium. It may however be called an ability to control the unstable equilibrium. This ability has been referred to as dynamic stability [3], which in some situations seem equivalent to what is traditionally known as 'balance'. Balance is commonly referred to as the ability to control stability and body position relative to base of support (BOS) [7, 27]. The human body in an upright stance maintain in a balanced position if the centre of mass (COM) is within the BOS [3]. The BOS is a crucial contributor of determining the difficulty in maintaining a balanced position. For example, a narrow stance provides a small BOS and makes it more difficult to maintain balance than a wide stance. The appropriate terminology for controlling body posture appears to be varying depending on the context in which it is viewed. The concept of core stability continues to vary in description across studies [4]. Core stability is interchangeably referred to as core strength, which is a fundamentally different concept than stability [5]. Strength is usually associated with maximal force and a high intensity, but in some cases, strength may be required to maintain functional stability [5]. Previous practitioners have mistakenly believed that core stability primarily involve local core muscles, and that core strength primarily involve global core muscles [23]. It is important to establish that neither local nor global core muscles can be trained independently, and that functional movement is consisting of a precise collaboration between these two stabilizing systems [5, 23].

Core stability and balance are common abilities for athletes to emphasize in the athletic training outside of competition [7, 23]. Core strength and core stability appear in research to be fundamental in sports activities that include upper and lower extremity, in which it contributes to produce and transfer force between segments [23]. This may promote core strength and stability training for ski jumpers as they rely on producing and transferring force from lower to upper extremities in the take-off phase. However, the conditions that challenge ski jumpers vary from each phase. The flight phase set more requirement to controlling the flight and maintaining a balanced position. The athletes' varying ability to master different challenges has created interest in research. A study from the Olympics in Salt Lake City found that the best ski jumpers had a better ability to compensate unexpected variables, such as low air density, than the rest. It further showed that there was an advantage in reaching the flight position very fast [22]. Another study argued that ski jumpers can use the core to regulate body posture at the instant of take-off [13]. It appears from these studies that it can be beneficial for a ski jumper's sport performance to reach a stable flight as soon as possible after take-off, and that this can be achieved by adjusting the core and controlling body posture. Although much research is done on balance and postural control, most of it is in a clinical setting, a minority in a sports performance setting [27]. It is important to acknowledge the in-field conditions in competition and recreate those conditions in training to optimize the transfer to performance. As previously mentioned, there are numerous studies showing contradicting results of core stability training on sport performance [11, 14, 17, 19, 21]. It is argued that the principle of specificity in the training approaches of these studies can explain the contradiction [14]. The principle of specificity describes how the conditions during training should simulate the conditions during competition [26]. This approach is argued to be particularly important for experienced athletes that needs to improve specific abilities or functions to be able to optimize their sport performance [6, 26].

Current literature does not provide a standardised and validated test battery for core stability [8, 14]. It further has a limited body of research regarding sport-specific balance measurements during functional tasks [27]. The Sahrmann core stability test is frequently used to assess core stability [19], while maintaining an upright stance on a force platform is frequently used to assess balance [3]. However, there are many modified versions across studies in both core stability and balance assessments [1, 2, 5, 27], and it is generally accepted that all measurements of associated determinants of performance must emphasize specificity. Athletic training in ski jumping implement several exercises for training and testing core stability, in which two are practiced to specifically improve the flight phase.

The purpose of this study was to examine the association between core stability, balance and ski-jumping performance ability in competitive ski jumpers, more specifically between the steadiness (lack of motion) in flight simulated static tasks and ski-jumping performance ability (ranking) as assessed by trainers. A positive association between these performance abilities was hypothesized.

Methods

Experimental approach to the problem

A cross-sectional study design was used to investigate two common core exercises from the athletic training for Norwegian ski jumpers. The performance from these exercises was compared to ski-jumping performance ability in competitive ski jumpers of different level. The core exercises were reduced from a long duration to a duration comparable to the flight phase. Testing was videotaped and followed by the coaches, but without giving any feedback to the participants.

Participants

Eleven Norwegian male ski jumpers ranging from a national to an international performance level participated in this study. Performance ability, anthropometrics, age, and experience are presented in *table 1*.

Table 1. Performance ability, anthropometrics, age, and experience (N=11).

Performance ability (rank)	Weight (kg)	Height (cm)	Age (y)	Experience (y)
1	63.6	178.6	21	16
2	73.3	187.4	28	22
3	64.3	175.1	23	16
4	60.4	174.9	19	12
5	65.1	178.1	21	7-8
6	65.9	183.3	19	16
7	61.4	177.9	18	9-10
8	60.9	178.2	21	12
9	57.3	161.0	16	7
10	72.2	189.8	19	11-12
11	47.5	158.1	16	6

Table 1 show the participants in a ranked order of performance ability (1 = best, 11 = worst), anthropometrics divided into weight and height, age and training experience in ski jumping.

A notification form was completed and approved by Norwegian Centre for Research Data [appendix 1, appendix 2]. Participants were informed about study background, purpose, methods and that it was voluntary before signing a participation form [appendix 3].

Performance ability was based on last year's FIS-ranking and further adjusted by five experienced coaches. The participants were selectively ranked on a scale from one to eleven (1 = best, 11 = worst). The coaches had experience in coaching ski jumpers from a local to an international level, as well as personally being former ski jumpers. They had developed an impression of quality for every participant in this study from their long experience of following them. The impression of quality was based on the ski jumpers' competitive results, how they execute various exercises, and their rate of consistency and seriousness.

Test protocol

The participants performed two exercises for 15 seconds in five sets, with a 30 second break between each set. The exercises are presented in *figure 1* and consisted of holding a flight similar posture as stable and consistent as possible. The plank exercise can be described as follows: The participant was instructed to maintain a constant posture without being challenged for balance. The balance exercise can be described as follows: The participant was instructed to maintain a constant body orientation while balancing on a fulcrum and working against gravity. The plank exercise was performed between a 54cm box (left) and a 70cm box (right), while the balance exercise was performed on a gymnastic bar. Ten of the eleven participants and all their coaches were already familiar with both exercises from previous training sessions. Each participant was given the opportunity to try the exercise before the testing started. The remaining one participants had a longer opportunity to try out the one exercise that he was unfamiliar with. They were reminded to copy their flight posture before performing the exercises.

Figure 1. Plank exercise (left) and Balance exercise (right).

Equipment and procedure

Inertial measurement units (IMUs) provided by ZXY wearable tracking (from ChyronHego corporation) were used to obtain acceleration and angular velocity. Oqus cameras and Qualisys Track Manager (QTM) software were used to determine segment, joint angle and position. The sample rate for the IMUs was 100 Hz and for QTM was 250 Hz.

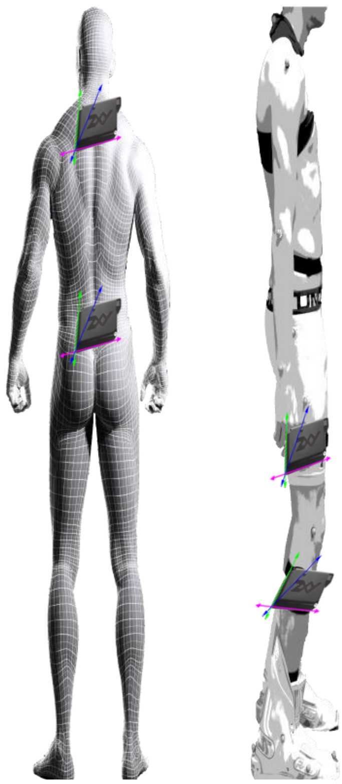

Figure 2. Position of markers and measurement units.

Oqus markers were attached to the participants’ skin or jump suit using double-coated tape, while the IMUs were attached using elastic straps or an accepted substitute. Every marker and measurement unit was attached to a standardised anatomical position (demonstrated in *figure 2*). The IMUs were placed on the following positions: neck (between C6 and C7), lower back (between right and left iliac crest), thigh (in the middle of the lateral side of femur), and leg (in the middle of the lateral side of fibula). The Oqus markers were placed on the following positions: neck (C7), lower back (L5), hip (greater trochanter), pelvis (spina iliaca posterior superior), knee (lateral femoral epicondyle), shoulder (lateral end of acromion process), elbow (lateral humeral epicondyle), and wrist (ulnar styloid process). The Oqus and QTM was calibrated before testing, and a 5th IMU was static during the recording and thus measuring the noise band to assure that the signal received from the other IMUs was well above the noise level (see results).

The middle ten seconds of the exercise were event marked and analysed for variation in the various signals (acceleration, angular velocity, and position). The plank exercise was measured by the accelerometers, gyroscopes and Oqus markers from the trunk region, while the balance exercise was measured by the accelerometers, gyroscopes and Oqus markers from both the upper and lower extremities. Segments- and joint angles were calculated to investigate body configuration. The variables measured in the plank exercise were acceleration from lower back and thigh, angular velocity from lower back and thigh, and angle data from hip, trunk and thigh. The variables measured in the balance exercise were acceleration from neck, lower back, thigh and leg, angular velocity from neck, lower back, thigh and leg, and angle data from hip, trunk, thigh, shoulder, elbow, arm and forearm. Only motion in the sagittal plane was considered in the analysis.

Statistical analyses

QTM software was imported into MATLAB (2016) and IBM SPSS Statistics 24 for further assessment. Spearman's rank correlation coefficient was used to compare the test results to performance ability (ranking 1-11). Pearson correlation coefficient was used to compare the test results to anthropometrics (weight, height, BMI). Variation in movement of each exercise was quantified using the standard deviation (SD) of the relevant signal over the middle ten seconds and taking the average of that value over the five repetitions.

Results

The following results present an analysis of the variables measured compared to ski-jumping performance ability and anthropometrics. There were three significant correlations from the Spearman analysis. Two of the variables measured in the plank exercise showed a negative correlation and one of the variables measured in the balance exercise showed a positive correlation. There were three significant correlations from the Pearson analysis, with all three variables from the balance exercise showing a positive correlation. *Figure 3* show a comparison of the noise band from the stationary IMU and signal plus noise from the IMU positioned on the lower back in an up-downward direction during the plank exercise. The stationary IMU captured a mean noise band (SD) of 0.00765 m/s2 from the accelerometer and 0.0009 rad/s from the gyroscope during the testing sequence.

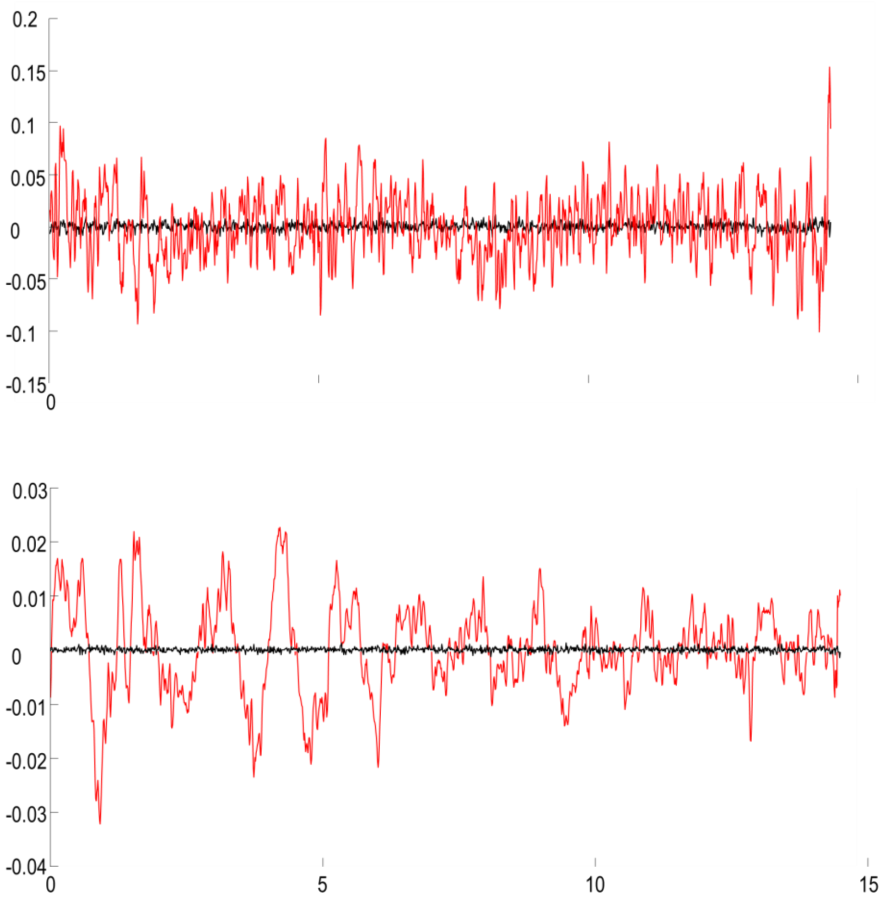

Figure 3. X-Y presentation of noise band and signal against time (s). SD of acceleration (m/s2) from the lower back (red) and stationary sensor (black) in the top figure; SD of angular velocity (rad/s) from the lower back (red) and stationary sensor (black) in the bottom figure.

Table 2 show the correlation coefficient between the variables measured in the plank exercise compared to performance ability and anthropometrics. *Table 3* show the correlation coefficient between the variables measured in the balance exercise compared to performance ability and anthropometrics. Acceleration and angular velocity, and angle from the neck area were not included in *table 2* considering that the neck was passive (on top of the right box as demonstrated in *figure 1*) during the exercise. Correlations are between SD of the depicted variables and rank, weight, height and BMI.

Table 2. Relationship (by Spearman rank correlation, rho, and Pearson correlation, r; N=11) between performance ability (rank) and SD of task execution variables in the plank exercise.

Variables	Performance ability		Weight		Height		BMI	
	rho	p	r	p	r	p	r	p
Acceleration								
lower back	-.909**	<0.001	.526	0.097	.429	0.188	.337	0.312
thigh	-.355	0.285	.487	0.128	.505	0.113	.030	0.929
Angular velocity								
lower back	-.718*	0.013	.212	0.532	.234	0.489	-.023	0.948
thigh	-.155	0.650	.239	0.479	.174	0.609	.202	0.551
Angle								
hip	.582	0.060	.227	0.501	.258	0.444	-.079	0.817
trunk	.382	0.247	.129	0.705	.087	0.799	.099	0.773
thigh	.445	0.170	.164	0.629	.250	0.459	-.245	0.467

***. Strong significant correlation (2-tailed).*
**. Moderate significant correlation (2-tailed).*

SD of acceleration and angular velocity from lower back correlated with performance ability. Variation in hip angle was not significant, but showed a relatively high p value. Mean values from trunk angle were additionally analysed to investigate posture (trunk position). The mean values showed a moderate significant positive correlation to performance ability (p=0.044), indicating that there was a technical difference in how the participants executed the exercise. The best ranked participant was angled more downward than the worst ranked participant (best: mean value of -0.10971 rad, worst: mean value of 0.00488 rad). The grand average of SD during the ten seconds for segment and joint angles was 0.015 rad (0.83 degrees), indicating that movement variation was very small.

Table 3. Relationship (by Spearman rank correlation, rho, and Pearson correlation, r; N=11) between performance ability (rank) SD of task execution variables in the balance exercise.

Variables	Performance ability		Weight		Height		BMI	
	rho	p	r	p	r	p	r	p
Acceleration								
neck	.027	0.937	.598	0.052	.517	0.104	.219	0.518
lower back	.082	0.811	.217	0.521	.235	0.486	-.049	0.885
thigh	.282	0.401	.289	0.389	.346	0.297	-.139	0.683
leg	.373	0.259	.391	0.235	.415	0.204	-.040	0.908
Angular velocity								
neck	-.109	0.750	.578	0.063	.561	0.072	.088	0.797
lower back	-.109	0.750	.599	0.051	.618*	0.043	.005	0.988
thigh	.127	0.709	.451	0.164	.475	0.140	-.035	0.018
leg	.018	0.958	.503	0.115	.517	0.103	.009	0.978
Angle								
hip	-.164	0.631	.536	0.090	.469	0.146	.184	0.589
trunk	-.064	0.853	.655*	0.029	.552	0.079	.274	0.414
thigh	-.045	0.894	.505	0.113	.458	0.156	.128	0.708
shoulder	.109	0.750	.600	0.051	.506	0.112	.255	0.448
elbow	.618*	0.043	.292	0.383	.279	0.406	.019	0.955
arm	.173	0.612	.642*	0.033	.578	0.063	.164	0.631
forearm	.382	0.247	.451	0.164	.378	0.252	.168	0.622

***. Strong significant correlation (2-tailed).*
**. Moderate significant correlation (2-tailed).*

Elbow angle correlated with performance ability, trunk and arm angle correlated with weight, and angular velocity from lower back correlated with height. Mean values from hip angle were additionally compared to both performance ability and height without showing any significant difference. The grand average of SD during the ten seconds for segment and joint angles was 0.037 rad (2.13 degrees), indicating that movement variation was small. The significant Spearman correlations from table 2 and 3 are presented in *figure 4* as line plots.

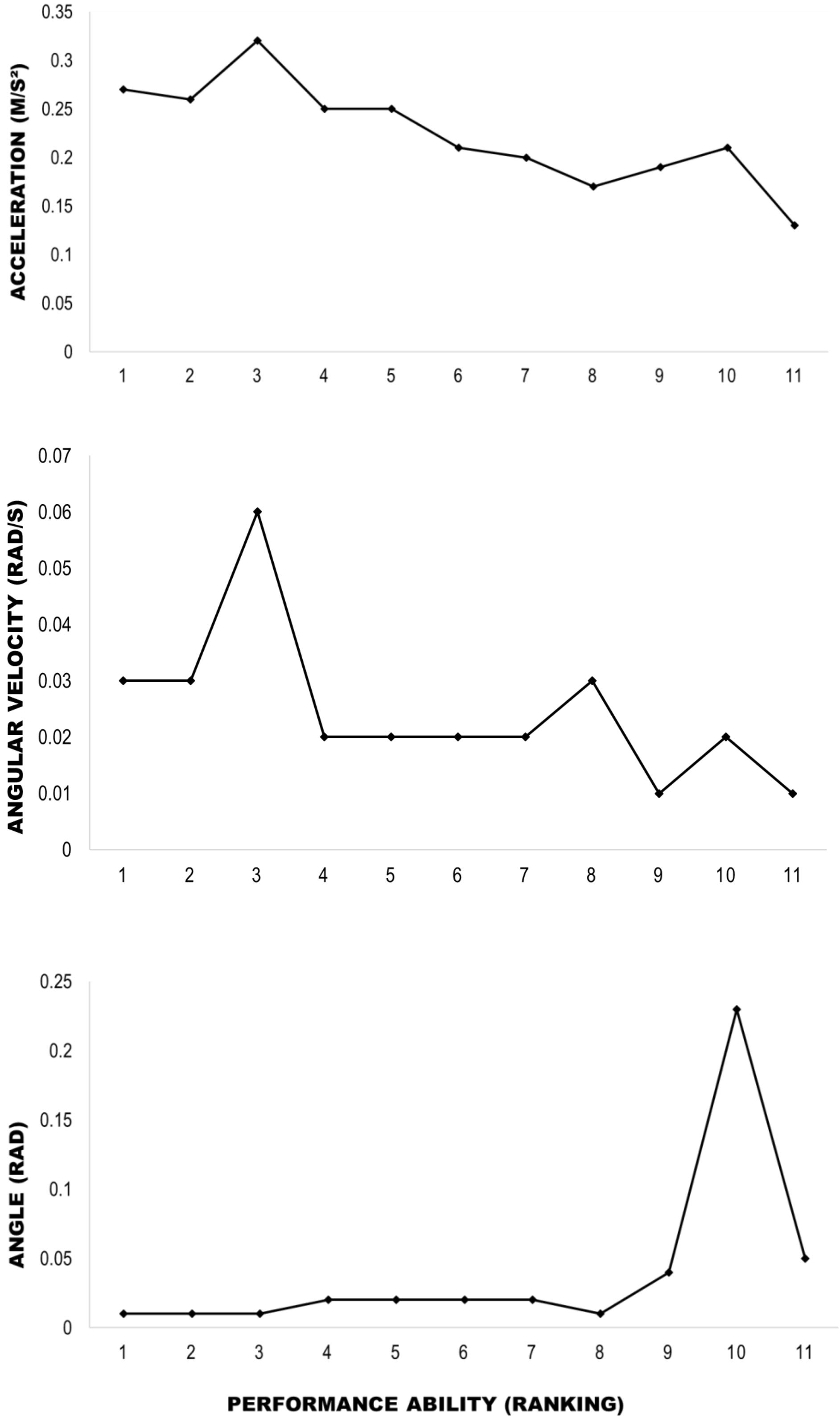

Figure 4. X-Y presentation of the significant correlations from the Spearman analysis presenting SDs (lower back acceleration, lower back angular velocity, elbow angle) against performance ability (rank).

Discussion

The purpose of this study was to examine the variation of motion in two static tasks and compare the results to sport performance ability in competitive ski jumpers. The static tasks were exercises from Norwegian ski jumpers' normal athletic training routine. Variation of motion was expressed by SDs (the middle ten seconds) from acceleration, angular velocity and changes in angle and position. This study consisted of eleven participants, which may be considered a limitation although the participants were ranging from a national junior level to an international elite level.

The main findings from the plank exercise show negative relationships between the steadiness in the lower back (i.e. minimizing acceleration and angular velocity) and performance ability. It further shows a positive relationship between trunk position and performance ability. The main findings from the balance exercise show a positive relationship between elbow movement (variation in angle) and performance ability, and positive relationships between arm movement (variation in angle) and weight, trunk movement (variation in angle) and weight, and lower back steadiness (angular velocity) and height.

Correlations to performance ability

SD of acceleration from the lower back show a strong relationship to performance ability, and SD of angular velocity from the lower back show a moderate relationship to performance ability. These results indicate that the best ranked athletes had more motion in the lower back area in comparison to the lower ranked athletes. It suggests that the applicability of holding a static flight similar posture for sport performance in ski jumping is not a factor of importance. The significant ranking effect on variation in acceleration and angular velocity and the non-significant effects on angle variations from the lower back area indicate small and rapid amplitude motion, being shaking, rather than large and slow movements. The relationship between trunk position and performance ability indicate a technical difference in how the participants executed the plank exercise. It raises a question to what extent the technical difference affects the ability to minimize motion and whether it was matching differences in muscle activation between the participants. A possibly follow-up study can measure electromyography and investigate these differences to see if the lower ranked athletes used an easier technique, or if they were just better at executing the exercise.

Variation in elbow angle showed a moderate relationship to performance ability, although it may be affected by skewness of data (*figure 4*). The results indicate that the best ranked athletes had more elbow movement compared to the lower ranked athletes. A further analysis of the video recordings revealed that there also was a technical difference between the athletes in the execution of the balance exercise. The technical difference was that four of the five best ranked participants deliberately adjusted balance with their hands elevated from the gymnastic bar (as shown in *figure 1*). The lower ranked participants tended to drop their hands on to the gymnastic bar possibly to increase BOS and maintain balance. The technical difference is not considered to be a limitation because it is expected that ski jumpers have a technical difference in maintaining balance in the flight phase. It may however explain the significant correlations found between elbow angle and performance ability.

Correlations to anthropometrics

Arm and trunk angle show a moderate relationship to weight, and angular velocity from the lower back show a moderate relationship to height. These results indicate that weight and height can affect the ability to maintain a static position in these exercises, and that further investigations on ski jump performance may consider including anthropometrics.

It was assumed that hip angle would affect performance in the balance exercise. The reason for this assumption was that a flexed hip would curve around the gymnastic bar and create a smaller moment of inertia, and thus decrease the difficulty of maintaining a balanced position. The difference in hip angle and the variables measured were however non-significant. There were no further correlations between hip angle and height.

Practical applications

The first impression from this study was that the exercises for core stability and balance training were not relevant for performance ability in ski jumping. It questions the specificity of the exercises and whether the variables measured can be considered as determinants of performance. The main argument for this scepticism is that the exercises are designed to improve the flight phase, but they are performed as static tasks, while the flight phase is continuously being in motion. The plank and balance exercises occur in the same plane of motion as the flight phase, with a comparable duration, but it may not be specific enough to have an affection on ski jump performance.

The principle of specificity is an important factor in the research on training transfer. Some of the research regarding the transfer from core stability training to sport performance has tested sport-specific variables (e.g. throwing velocity in handball and club head speed in golf) before and after the training intervention to measure improvements [2, 14, 17, 19]. However, specificity is only to be found in a minority of the interventions conducted [14]. The sport-specific variables can be considered as associated determinants of performance, but they should be implemented in the interventions to optimize the training transfer. Exercises that are designed to improve the flight phase may need to consider recreating the forces that are acting on the ski jumper during the flight to a training scenario in order to be flight-specific. Although specificity is important for training transfer, the level of specificity necessary for a transfer to occur depends on the athletes' level of performance. Low level athletes can benefit from non-specific training, contrary to high level athletes [6]. Training load is also an important factor for the training transfer, but the variation of motion in this study was not compared to the amount of experience the participants had with the exercises from previous training. Future research regarding flight performance need to acknowledge which variables are flight-specific and implement those variables in a training intervention to investigate training transfer. This study assessed training associated determinants of performance rather than investigating how specific the variables measured were. The variables measured were converted from an athletic training context (ability to be stable) to a laboratory context (ability to minimize motion) with a purpose of measuring the ability that these exercises intended to train. It is reasonable to assume that the exercises are relevant for ski jump performance, considering that they are a part of the athletic training routine for both low level and high level ski jumpers. However, the ability of doing these exercises may not be a determinant. The training routine consists of a great collection of exercises that intend to improve various aspects of the movement sequence in ski jumping. The relationship between the two exercises in this study and performance ability would therefore not be representative for the athletic training in general.

Flight performance is, as previously mentioned, only a part of the total performance score for ski-jumping performance ability. One could speculate whether there is a positive relationship between the performance ability (total score) used in this study and flight performance. Repeated ski jumps could contribute to quantify flight performance, but it was assumed that it would constrict the wide range of performance level (considering that elite athletes have limited time) without being significantly more reliable or valid (performance of a short period is determined by the athletes' current physical, mental state and weather).

Conclusions

- The results from the present study do not support the hypothesis.
- Small amplitude motion in the lower back during the plank exercise is related to ski-jumping performance ability, as ranked by trainers.
- Technical execution (i.e. trunk position in the plank exercise and use of arms in the balance exercise) of both exercises was associated to performance ability.

References

1) Bruhn S, Kullmann N, Gollhofer A. The effects of a sensorimotor training and a strength training on postural stabilisation, maximum isometric contraction and jump performance. *Int J Sports Med.* 2004;25(1):56-60.
2) Butcher SJ, Craven BR, Chilibeck PD, Spink KS, Grona SL, Sprigings EJ. The effect of trunk stability training on vertical takeoff velocity. *JOSPT*. 2007;37(5):223-31.
3) Cotoros D, Baritz M. Biomechanical analyzes of human body stability and equilibrium. Proceedings of the world congress of engineering. Vol 2. 2010. London U.K.
4) Haugen T, Haugvad L, Røstad V. Effects of core-stability training on performance and injuries in competitive athletes. *Sportscience*. 2016;20:1-7.
5) Hibbs AE, Thompson KG, French D, Wrigley A, Spears I. Optimizing performance by improving core stability and core strength. *Sports Med.* 2008;38(12):995-1008.
6) Issurin VB. Training transfer: scientific background and insight for practical application. *Sports Med*. 2013;43(8):675-94.
7) Knudson D. Fundamentals of biomechanics. 2^{th} ed. Springer; 2007. p. 169-91.
8) Majewski-Schrage T, Evans TA, Ragan B. Development of a core-stability model: a Delphi approach. *J Sport Rehabil*. 2014;23(2):95-106.
9) Müller W. Determinants of ski-jump performance and implications for health, safety and fairness. *Sports Med*. 2009;39(2):85-106.

10) Olympiatoppen Web site [Internet]. Oslo: Olympiatoppen; [cited 2017 Mars 23]. Available from: http://www.olympiatoppen.no.

11) Parkhouse KL, Ball N. Influence of dynamic versus static core exercises on performance in field based fitness tests. *J Bodyw Mov Ther*. 2011;15(4):517-24.

12) Reed CA, Ford KR, Myer GD, Hewett TE. The effects of isolated and integrated core stability training on athletic performance measures: a systematic review. *Sports Med*. 2012;42(8):697-706.

13) Remizov, LP. Biomechanics of optimal flight in ski-jumping. *J Biomech*. 1984;17(3):167-71.

14) Saeterbakken AH, van den Tillaar R, Seiler S. Effect of core stability training on throwing velocity in female handball players. *J Strength Cond Res.* 2011;25(3):712-8.

15) Schache AG, Bennell KL, Blanch PD, Wrigley TV. The coordinated movement of the lumbo–pelvic–hip complex during running: a literature review. *Elsevier*. 1999;10(1):30-47.

16) Schwameder H. Biomechanics research in ski jumping, 1991-2006. *Sports Biomech*. 2008;7(1):114-36.

17) Sharma A, Geovinson SG, Singh Sandhu J. Effects of a nine-week core strengthening exercise program on vertical jump performances and static balance in volleyball players with trunk instability. *J Sports Med Phys Fitness.* 2012;52(6):606-15.

18) Silfies SP, Ebaugh D, Pontillo M, Butowicz CM. Critical review of the impact of core stability on upper extremity, athletic injury and performances. *Braz J Phys Ther*. 2015.

19) Stanton R, Reaburn PR, Humphries B. The effect of short-term Swiss ball training on core stability and running economy. *J Strength Cond Res.* 2004;18(3):522-8.

20) The International Olympic Committee [Internet]. *The International Ski Competition Rules (ICR)*. Switzerland: Book 3 Ski Jumping; 2016. 61 p. Available from: http://www.fis-ski.com.

21) Thompson CJ, Cobb KM, Blackwell J. Functional training improves club head speed and functional fitness in older golfers. *J Strength and Cond Res*. 2007:21(1),131-7.

22) Virmavirta M, Isolehto J, Komi P, Brüggemann GP, Müller E, Schwameder H. Characteristics of the early flight phase in the Olympic ski jumping competition. *J Biomech*. 2005;38(11):2157-2163.

23) Willardson JM. Core stability training: applications to sports conditioning programs. *J Strength Cond Res*. 2007;21(3):979-85.

24) Willardson JM. Developing the Core. *Sport Performance Series.* National Strength and Conditioning Association. Human Kinetics; 2014. p. 3-18.

25) Young HD, Freedman RA, Sandin TR, Ford AL. Sears and Zemansky's university of physics: With modern physics. 10th ed. Addison wesley longman; 2000. p. 216.

26) Young WB. Transfer of strength and power training to sports performance. *Int J Sports Physiol Perform*. 2006;1(2):74-83.

27) Zemková E. Assessment of balance in sport: science and reality. *Serb J Sports Sci*. 2011;5(4):127-39.

Appendix 1

Notification form to Norwegian Centre for Research Data:

MELDESKJEMA

Meldeskjema (versjon 1.4) for
forsknings- og studentprosjekt
som medfører meldeplikt eller

konsesjonsplikt (jf. personopplysningsloven og helseregisterloven med forskrifter).

1. Intro		
Samles det inn direkte personidentifiserende opplysninger?	Ja ● Nei ○	En person vil være direkte identifiserbar via navn, personnummer, eller andre personentydige kjennetegn. Les mer om hva personopplysninger. NB! Selv om opplysningene skal anonymiseres i oppgave/rapport, må det krysses av dersom det skal innhentes/registreres personidentifiserende opplysninger i forbindelse med prosjektet.
Hvis ja, hvilke?	■ Navn □ 11-sifret fødselsnummer □ Adresse □ E-post □ Telefonnummer □ Annet	
Annet, spesifiser hvilke		
Skal direkte personidentifiserende opplysninger kobles til datamaterialet (koblingsnøkkel)?	Ja ● Nei ○	Merk at meldeplikten utløses selv om du ikke får tilgang til koblingsnøkkel, slik fremgangsmåten ofte er når man benytter en databehandler
Samles det inn bakgrunnsopplysninger som kan identifisere enkeltpersoner (indirekte personidentifiserende opplysninger)?	Ja ● Nei ○	En person vil være indirekte identifiserbar dersom det er mulig å identifisere vedkommende gjennom bakgrunnsopplysninger som for eksempel bostedskommune eller arbeidsplass/skole kombinert med opplysninger som alder, kjønn, yrke, diagnose, etc. NB! For at stemme skal regnes som personidentifiserende, må denne bli registrert i kombinasjon med andre opplysninger, slik at personer kan gjenkjennes.
Hvis ja, hvilke	Rankingsystem innen idretten	
Skal det registreres personopplysninger (direkte/indirekte/via IP-/epost adresse, etc) ved hjelp av nettbaserte spørreskjema?	Ja ○ Nei ●	Les mer om nettbaserte spørreskjema.
Blir det registrert personopplysninger på digitale bilde- eller videoopptak?	Ja ● Nei ○	Bilde/videoopptak av ansikter vil regnes som personidentifiserende.
Søkes det vurdering fra REK om hvorvidt prosjektet er omfattet av helseforskningsloven?	Ja ○ Nei ●	NB! Dersom REK (Regional Komité for medisinsk og helsefaglig forskningsetikk) har vurdert prosjektet som helseforskning, er det ikke nødvendig å sende inn meldeskjema til personvernombudet (NB! Gjelder ikke prosjekter som skal benytte data fra pseudonyme helseregistre). Dersom tilbakemelding fra REK ikke foreligger, anbefaler vi at du avventer videre utfylling til svar fra REK foreligger.
2. Prosjekttittel		
Prosjekttittel	The Relationship between Jump Variations, Core Control and Sport Performance in Ski Jumping	Oppgi prosjektets tittel. NB! Dette kan ikke være «Masteroppgave» eller liknende, navnet må beskrive prosjektets innhold.
3. Behandlingsansvarlig institusjon		
Institusjon Avdeling/Fakultet Institutt	NTNU Det medisinske fakultet Institutt for nevromedisin	Velg den institusjonen du er tilknyttet. Alle nivå må oppgis. Ved studentprosjekt er det studentens tilknytning som er avgjørende. Dersom institusjonen ikke finnes på listen, har den ikke avtale med NSD som personvernombud. Vennligst ta kontakt med institusjonen.
4. Daglig ansvarlig (forsker, veileder, stipendiat)		

Fornavn Etternavn Stilling Telefon Mobil E-post Alternativ e-post Arbeidssted Adresse (arb.) Postnr./sted (arb.sted)	Gertjan Ettema Professor 48112969 48112969 gertjan.ettema@ntnu.no gertjan.ettema@ntnu.no NTNU Granåsen Høgskoleringen 1 7491 Trondheim	Før opp navnet på den som har det daglige ansvaret for prosjektet. Veileder er vanligvis daglig ansvarlig ved studentprosjekt. Veileder og student må være tilknyttet samme institusjon. Dersom studenten har ekstern veileder, kanbiveileder eller fagansvarlig ved studiestedet stå som daglig ansvarlig. Arbeidssted må være tilknyttet behandlingsansvarlig institusjon, f.eks. underavdeling, institutt etc. NB! Det er viktig at du oppgir en e-postadresse som brukes aktivt. Vennligst gi oss beskjed dersom den endres.
5. Student (master, bachelor)		
Studentprosjekt	Ja ● Nei ○	Dersom det er flere studenter som samarbeider om et prosjekt, skal det velges en kontaktperson som føres opp her. Øvrige studenter kan føres opp under pkt 10.
Fornavn Etternavn Telefon Mobil E-post Alternativ e-post Privatadresse Postnr./sted (privatadr.) Type oppgave	Andreas Norwich 40600190 andreas.torum.norwich@gmail.com andreatn@stud.ntnu.no Asplia 9 7500 Stjørdal ● Masteroppgave ○ Bacheloroppgave ○ Semesteroppgave ○ Annet	
6. Formålet med prosjektet		
Formål	Vi skal registrere bevegelsesutslag idrettsutøvere i to treningsøvelser for "kjernekontroll" med bruk av akselerometer, samt imitasjonshopp i hall. Formålet er å se om det er sammenheng mellom prestasjonsnivå (verdensranking av utøvere), prestasjonen på de to kjernekontrolløvelsene og stabilitet i imitasjonshopp. Deltakere er godt kjent med alle øvelser i dette forsøk siden de gjennomfører disse regelmessig i deres trening.	Redegjør kort for prosjektets formål, problemstilling, forskningsspørsmål e.l.
7. Hvilke personer skal det innhentes personopplysninger om (utvalg)?		

Kryss av for utvalg	□ Barnehagebarn □ Skoleelever □ Pasienter □ Brukere/klienter/kunder □ Ansatte □ Barnevernsbarn □ Lærere □ Helsepersonell □ Asylsøkere ■ Andre	
Beskriv utvalg/deltakere	Norske aktive skihoppere	Med utvalg menes dem som deltar i undersøkelsen eller dem det innhentes opplysninger om.
Rekruttering/trekking	Koordinator mellom skilaget og NTNU Steinar Braaten står ansvarlig for å rekruttere via idrettsmiljøet	Beskriv hvordan utvalget trekkes eller rekrutteres og oppgi hvem som foretar den. Et utvalg kan trekkes fra registre som f.eks. Folkeregisteret, SSB-registre, pasientregistre, eller det kan rekrutteres gjennom f.eks. en bedrift, skole, idrettsmiljø eller eget nettverk.

Førstegangskontakt	Steinar Braaten skal i møte med hopptrenerne på Granåsen for å avtale passende tidspunkt for testing	Beskriv hvordan kontakt med utvalget blir opprettet og av hvem. Les mer om dette på temasidene.
Alder på utvalget	□ Barn (0-15 år) ■ Ungdom (16-17 år) ■ Voksne (over 18 år)	Les om forskning som involverer barn på våre nettsider.
Omtrentlig antall personer som inngår i utvalget	10-20	
Samles det inn sensitive personopplysninger?	Ja ○ Nei ●	Les mer om sensitive opplysninger.
Hvis ja, hvilke?	□ Rasemessig eller etnisk bakgrunn, eller politisk, filosofisk eller religiøs oppfatning □ At en person har vært mistenkt, siktet, tiltalt eller dømt for en straffbar handling □ Helseforhold □ Seksuelle forhold □ Medlemskap i fagforeninger	
Inkluderes det myndige personer med redusert eller manglende samtykkekompetanse?	Ja ○ Nei ●	Les mer om pasienter, brukere og personer med redusert eller manglende samtykkekompetanse.
Samles det inn personopplysninger om personer som selv ikke deltar (tredjepersoner)?	Ja ○ Nei ●	Med opplysninger om tredjeperson menes opplysninger som kan spores tilbake til personer som ikke inngår i utvalget. Eksempler på tredjeperson er kollega, elev, klient, familiemedlem.
8. Metode for innsamling av personopplysninger		

Kryss av for hvilke datainnsamlingsmetoder og datakilder som vil benyttes	□ Papirbasert spørreskjema □ Elektronisk spørreskjema □ Personlig intervju □ Gruppeintervju □ Observasjon □ Deltakende observasjon □ Blogg/sosiale medier/internett □ Psykologiske/pedagogiske tester □ Medisinske undersøkelser/tester □ Journaldata	Personopplysninger kan innhentes direkte fra den registrerte f.eks. gjennom spørreskjema,intervju, tester, og/eller ulike journaler (f.eks. elevmapper, NAV, PPT, sykehus) og/eller registre (f.eks.Statistisk sentralbyrå, sentrale helseregistre). NB! Dersom personopplysninger innhentes fra forskjellige personer (utvalg) og med forskjellige metoder, må dette spesifiseres i kommentar-boksen. Husk også å legge ved relevante vedlegg til alle utvalgs-gruppene og metodene som skal benyttes. Les mer om registerstudier her. Dersom du skal anvende registerdata, må variabelliste lastes opp under pkt. 15
	□ Registerdata	
	■ Annen innsamlingsmetode	
Oppgi hvilken	World Ranking Ski Jumping http://www.fis-ski.com/ski-jumping/leader-board/ Og eventuelt norgesranking	
Tilleggsopplysninger	Kontaktinformasjon av utøverne hentes gjennom kontaktpersonen Steinar Braaten	
9. Informasjon og samtykke		
Oppgi hvordan utvalget/deltakerne informeres	■ Skriftlig ■ Muntlig □ Informeres ikke	Dersom utvalget ikke skal informeres om behandlingen av personopplysninger må det begrunnes. Les mer her. Vennligst send inn mal for skriftlig eller muntlig informasjon til deltakerne sammen med meldeskjema. Last ned en veiledende mal her. NB! Vedlegg lastes opp til sist i meldeskjemaet, se punkt 15 Vedlegg.
Samtykker utvalget til deltakelse?	● Ja ○ Nei ○ Flere utvalg, ikke samtykke fra alle	For at et samtykke til deltakelse i forskning skal være gyldig, må det være frivillig, uttrykkelig og informert. Samtykke kan gis skriftlig, muntlig eller gjennom en aktiv handling. For eksempel vil et besvart spørreskjema være å regne som et aktivt samtykke. Dersom det ikke skal innhentes samtykke, må det begrunnes.
Innhentes det samtykke fra foreldre for ungdom mellom 16 og 17 år?	Ja ○ Nei ●	Les mer om forskning som involverer barn og samtykke fra unge.

Hvis nei, begrunn	Dette regnes som et relativt lite forskningsprosjekt med ikke-sensitiv data, hvor deltager har mulighet til å trekke seg når som helst. Ser derfor ikke på samtykke fra foreldre som en nødvendighet.	
10. Informasjonssikkerhet		

Hvordan oppbevares navnelisten/ koblingsnøkkelen og hvem har tilgang til den?	Scanner informasjonen og legger på NTNU server. Det er bare de som jobber med prosjektet som vil ha tilgang til koblingsnøklene.	
Oppbevares direkte personidentifiserbare opplysninger på andre måter?	Ja ○ Nei ●	
Spesifiser	Verdensrankingen er offentlige dokumenter, men subjektene vil ikke bli nummeret i oppgaven slik at det er personidentifiserbart	NB! Som hovedregel bør ikke direkte personidentifiserende opplysninger registreres sammen med det øvrige datamaterialet.
Hvordan registreres og oppbevares personopplysningene?	■ På server i virksomhetens nettverk □ Fysisk isolert PC tilhørende virksomheten (dvs. ingen tilknytning til andre datamaskiner eller nettverk, interne eller eksterne) □ Datamaskin i nettverkssystem tilknyttet Internett tilhørende virksomheten □ Privat datamaskin □ Videoopptak/fotografi □ Lydopptak □ Notater/papir □ Mobile lagringsenheter (bærbar datamaskin, minnepenn, minnekort, cd, ekstern harddisk, mobiltelefon) □ Annen registreringsmetode	Merk av for hvilke hjelpemidler som benyttes for registrering og analyse av opplysninger. Sett flere kryss dersom opplysningene registreres på flere måter. Med «virksomhet» menes her behandlingsansvarlig institusjon. NB! Som hovedregel bør data som inneholder personopplysninger lagres på behandlingsansvarlig sin forskningsserver. Lagring på andre medier - som privat pc, mobiltelefon, minnepinne, server på annet arbeidssted - er mindre sikkert, og må derfor begrunnes. Slik lagring må avklares med behandlingsansvarlig institusjon, og personopplysningene bør krypteres.
Annen registreringsmetode beskriv		
Hvordan er datamaterialet beskyttet mot at uvedkommende får innsyn?	Beskyttet passord og tilgang til server	Er f.eks. datamaskintilgangen beskyttet med brukernavn og passord, står datamaskinen i et låsbart rom, og hvordan sikres bærbare enheter, utskrifter og opptak?
Samles opplysningene inn/behandles av en databehandler?	Ja ○ Nei ●	Dersom det benyttes eksterne til helt eller delvis å behandle personopplysninger, f.eks. Questback, transkriberingsassistent eller tolk, er dette å betrakte som en databehandler. Slike oppdrag må kontraktsreguleres.
Hvis ja, hvilken		
Overføres personopplysninger ved hjelp av e-post/Internett?	Ja ○ Nei ●	F.eks. ved overføring av data til samarbeidspartner, databehandler mm. Dersom personopplysninger skal sendes via internett, bør de krypteres tilstrekkelig. Vi anbefaler for ikke lagring av personopplysninger på nettskytjenester. Dersom nettskytjeneste benyttes, skal det inngås skriftlig databehandleravtale med leverandøren av tjenesten.
Hvis ja, beskriv?		
Skal andre personer enn daglig ansvarlig/student ha tilgang til datamaterialet med personopplysninger?	Ja ○ Nei ●	
Hvis ja, hvem (oppgi navn og arbeidssted)?		
Utleveres/deles personopplysninger med andre institusjoner eller land?	● Nei ○ Andre institusjoner ○ Institusjoner i andre land	F.eks. ved nasjonale samarbeidsprosjekter der personopplysninger utveksles eller ved internasjonale samarbeidsprosjekter der personopplysninger utveksles.

11. Vurdering/godkjenning fra andre instanser		
Søkes det om dispensasjon fra taushetsplikten for å få tilgang til data?	Ja ○ Nei ●	For å få tilgang til taushetsbelagte opplysninger fra f.eks. NAV, PPT, sykehus, må det søkes om dispensasjon fra taushetsplikten. Dispensasjon søkes vanligvis fra aktuelt departement.
Hvis ja, hvilke		
Søkes det godkjenning fra andre instanser?	Ja ○ Nei ●	F.eks. søke registereier om tilgang til data, en ledelse om tilgang til forskning i virksomhet, skole.
Hvis ja, hvilken		
12. Periode for behandling av personopplysninger		

Prosjektstart Planlagt dato for prosjektslutt	16.10.2016 01.06.2017	Prosjektstart Vennligst oppgi tidspunktet for når kontakt med utvalget skal gjøres/datainnsamlingen starter. Prosjektslutt: Vennligst oppgi tidspunktet for når datamaterialet enten skalanonymiseres/slettes, eller arkiveres i påvente av oppfølgingsstudier eller annet.
Skal personopplysninger publiseres (direkte eller indirekte)?	□ Ja, direkte (navn e.l.) □ Ja, indirekte (bakgrunnsopplysninger) ■ Nei, publiseres anonymt	NB! Dersom personopplysninger skal publiseres, må det vanligvis innhentes eksplisitt samtykke til dette fra den enkelte, og deltakere bør gis anledning til å lese gjennom og godkjenne sitater.
Hva skal skje med datamaterialet ved prosjektslutt?	■ Datamaterialet anonymiseres □ Datamaterialet oppbevares med personidentifikasjon	NB! Her menes datamaterialet, ikke publikasjon. Selv om data publiseres med personidentifikasjon skal som regel øvrig data anonymiseres.Med anonymisering menes at datamaterialet bearbeides slik at det ikke lenger er mulig å føre opplysningene tilbake til enkeltpersoner. Les mer om anonymisering.
13. Finansiering		
Hvordan finansieres prosjektet?	Masteroppgave ved Norges teknisk-naturvitenskapelige Universitet med vanlig driftsbudsjett	
14. Tilleggsopplysninger		
Tilleggsopplysninger		

Appendix 2

Approval from Norwegian Centre of Research Data:

Gertjan Ettema
Institutt for nevromedisin NTNU
Medisinsk teknisk forskningssenter
7489 TRONDHEIM

Vår dato: 18.10.2016 Vår ref: 50014 / 3 / AGH Deres dato:
Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 16.09.2016. Meldingen gjelder prosjektet:

50014	*The Relationship between Jump Variations, Core Control and Sport Performance in Ski Jumping*
Behandlingsansvarlig	*NTNU, ved institusjonens øverste leder*
Daglig ansvarlig	*Gertjan Ettema*
Student	*Andreas Norwich*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 01.06.2017, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Agnete Hessevik

Kontaktperson: Agnete Hessevik tlf: 55 58 27 97

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 50014

Utvalget informeres skriftlig og muntlig om prosjektet og samtykker til deltakelse. Informasjonsskriv og samtykkeerklæring er noe mangelfullt utformet. Vi ber derfor om at følgende endres/tilføyes:

- Det må framkomme at dere skal sammenligne testresultater med rankinger.
- Oppgi at datamaterialet anonymiseres ved prosjektslutt.
- Oppgi e-postadresse til veileder.
- Det står nå at prosjektet er i samarbeid med Olympiatoppen. Dersom opplysninger skal utleveres til personer iOlympiatoppen (at disse regnes tilknyttet prosjektet), må dette informeres om.

Revidert informasjonsskriv skal sendes til personvernombudet@nsd.no før utvalget kontaktes.

Personvernombudet legger til grunn at forsker etterfølger NTNU sine interne rutiner for datasikkerhet.

Forventet prosjektslutt er 01.06.2017. Ifølge prosjektmeldingen skal innsamlede opplysninger da anonymiseres. Anonymisering innebærer å bearbeide datamaterialet slik at ingen enkeltpersoner kan gjenkjennes. Det gjøres ved å:

- slette direkte personopplysninger (som navn/koblingsnøkkel)
- slette/omskrive indirekte personopplysninger (identifiserende sammenstilling av bakgrunnsopplysninger somf.eks. bosted/arbeidssted, alder og kjønn)

Appendix 3

Participation form:

Forespørsel om deltakelse i forskningsprosjektet

Skihoppstudie i Granåsen, 2016/2017

Bakgrunn og formål

Formålet med dette forskningsprosjektet er å kartlegge ulike bevegelsesparametere for skihopp, videre undersøke hvordan disse samsvarer med prestasjon i konkurransesammenheng. Prosjektet sammerfatter to mastergradsstudier ved Norges teknisk-naturvitenskapelige universitet, NTNU, i samarbeid med Olympiatoppen.

Vi ønsker derfor å ha med deg som forsøksperson.

Hva innebærer deltakelse i studien?

Datainnsamlingen vil foregå i Troppidrettssenteret i Granåsen. Målingene vil bli gjort med 3D-kameraer, spesialbygde skibindinger med kraftsensorer og akselerometre. Hver skihopper vil gjennomføre 15 imitasjonshopp og to plankeøvelser. Datainnsamlingen er estimert å ta 50-60 minutter per deltager, ikke medregnet oppvarming. Et nøyaktig tidsskjema vil være tilgjengelig under testdagen, for å gjøre oppvarming enklere. Under datainnsamlingen vil det også bli innhentet informasjon om vekt og høyde.

Hva skjer med informasjonen om deg?

Alle personopplysninger vil bli behandlet konfidensielt. Personopplysninger vil bli lagret lokalt, og det er kun personer tilknyttet prosjektet som vil ha tilgang til personopplysningene.

Prosjektet skal avsluttes sommeren 2017.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du ønsker å delta eller har spørsmål til studien, ta kontakt med meg, Andreas Tørum Norwich (telefonnr.: 40600190) eller Birk Eirik Fjeld (telefonnr.: 95709985), (eventuelt veileder Gertjan Ettema, telefonnr.: 48112969).
Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å delta

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(Signert av prosjektdeltaker, dato)