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# Biomechanical effects of Hip Thrust and Glute Bridge on hip extensors

DegreeendProject



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## Biomechanical effects of hip thrust and glute bridge on hip extensors

### Abstract

Horizontally loaded exercises have become very popular during the last years among strength and conditioning practitioners and coaches to enhance the performance of hip extensors. It has been shown that they are superior to the traditional standing free-weight exercises like squats or deadlifts in many aspects. The most famous exercise of this kind is the Barbell Hip Thrust, a close-kinetic chain exercise performed with a barbell to strengthen hip extensors. However, variations of the hip thrust have appeared, created by coaches to better suit their necessities, the most famous of them is the Loaded Glute Bridge. The aim of this paper is to analyze and compare the biomechanical differences existing between the barbell hip thrust, and the loaded glute bridge.

### Introduction

There is emerging body of evidence that shows the importance of hip extensors for sports performance. Hip extensors are the muscles that produce the greatest torque at the hip joint (Cahalan et al., 1989), as well as being of paramount importance in the everyday life movements such as walking (Lieberman, 2006). Regarding sports performance, hip extensor's role is critical to accelerate the body, especially when starting from a deep hip flexion: sprint accelerations, rising from a deep squat or climbing very steep hills (Neumann, 2010). Roberts & Belliveau, (2005) found that during uphill running, knee and ankle's contribution to the increased slope remained relatively equal when comparing to level running, while the increase in total work came from the hip joint. These authors suggested that this may be due to the increased moment arm on the hip. Furthermore, Martin & Brown (2009) showed that, during maximal and submaximal cycling, hip extension is the major power contributor.

Force application is also a decisive factor to achieve optimal results during running (Weyand et al., 2000). Hip extension is known to have a major role to accelerate the body when running (Neumann, 2010), likely because the propulsive phase requires a large amount of horizontal force application, which

is mostly produced by the hip. It is, therefore, critical for running performance (Brughelliet al., (2011); Nummela et al., 2007). Taken into account the existence of vertical forces, which are primarily produced to overcome the force of gravity, the increase in horizontal forces is relatively large as running intensity increases. While running at 40% of the maximum, horizontal forces were 11% of the vertical ones, but their magnitude increased to 18% when the subjects ran at maximum speed (Brughelli et al., 2011).

As a result, there is enough evidence to state that the role of hip joint is paramount for sports performance (Comfort et al., (2012); Lieberman, 2006; Neumann, 2010; Randell et al., (2010); T. J. Roberts & Belliveau, 2005), specially as the mechanical power requirements increase (Roberts & Belliveau, 2005; Martin & Brown, 2009)

Traditionally, exercises such as squats and leg curls have been used to strengthen hip extensors. In fact, Seitz et al., (2014) found that squats could help improving sprint times, even if they did not analyze other training exercises that might have led to better results. However, according to Contreras et al. (2011), the typical standing free-weight exercises, are not optimal to strengthen the muscles involved in movements with antero-posterior force vectors, mainly because they apply force vertically. Wretenberg et al. (1996) found a greater EMG activity in the group of subjects that lifted greater weights in both parallel and deep squats. In addition, from a research that studied the activation of different muscles of the hip while squatting at different depths (partial, parallel, deep), it can be concluded that the activation of the gluteus maximus muscle relied on the external load, rather than on the depth of the squat. If this is true, gluteus maximus recruitment may require training with big weights, which can be dangerous for many athletes that are not used to train in this way. Furthermore, squats for example may involve a powerful hip extension at the beginning of the movement, but its contribution rapidly decreases as the hip approaches full extension. This may be a major drawback for those athletes that need the hip to apply high levels of force when it is fully extended, for example in running related sports.

Therefore, resistance training exercises involving the antero-posterior force vector may have other advantages for running performance. Research has

shown that when running speed is over 70% of the maximum, horizontal force application is proportionally higher than the vertical one (Kuitunen et al., 2002). More recent research has also shown that the vertical forces eventually stop rising when running velocity is increasing from 60% to 80% of the maximum running velocity (Brughelli et al., 2011). These results highlight the importance that horizontally applied force (antero-posterior force vector) has in high intensity running.

The barbell hip thrust (Hence, HT), first described in the scientific literature by Contreras et al. (2011), is a free weight exercise that consists on performing a hip extension with a loaded barbell placed in the hip, while lying supine with the upper back on a bench and the knees in a 90° flexion. The movement starts with the disks in contact with the ground, and finishes when the hip reaches full extension. The force has to be applied in a horizontal fashion relative to the body as the hip extension is performed while lying supine, and gravitational forces make the hip undergo a great torque during the whole movement (Bezodis et al., 2017). For this reason, the barbell hip thrust is a great exercise for many sports in which explosive hip extensions near hip lockout are made.

Contreras et al. (2017), discovered that the hip thrust gave better results than front squats to improve 20m sprint times. Furthermore, the barbell hip thrust activates the gluteus maximus and the biceps femoris to a greater degree than the back squat (Contreras et al. 2015).

In the last years, HT has become very popular through sports practitioners and strength and conditioning coaches. This has allowed the creation of many new variations of the hip thrust exercise. In particular, the “loaded glute bridge” (Hence, GB) has earned popularity among athletes, presumably because of the higher loads that can be lifted with lesser effort. This exercise is technically almost equal to the HT, with the only difference consisting on placing the upper back on the ground, instead of a bench. This slight difference alters the whole biomechanical characteristics of the joints involved in the exercise, even though, to the best of our knowledge, no study has analyzed them. Consequently, the aim of the present study is to study the biomechanical

differences between the HT and the GB exercises, in order to provide a practical guide for coaches and sports practitioners when they need to choose between them. Specifically, we hypothesized that the GB exercise elicited a lesser vertical and total impulse, lesser barbell displacement and a less vertical loading direction relative to the ground. We also use the present paper to introduce a new concept: the vector-displacement index. This index is used to express numerically the relationship this two variables have in order to provide a tool to classify exercises for coaches and practitioners.

## Materials and methods

### *Subjects*

11 men (age  $23.5 \pm 3.63$  y, body mass  $78.6 \pm 13.8$  kg, height  $1.72 \pm 0.08$  m) volunteered to take part in this study. Subjects had a resistance training experience of at least 3 years and they had performed the HT exercise in their training sessions twice a week for at least one year. The subjects showed various training backgrounds, but most were athletes that used resistance training as a way to enhance their physical capacities. Others had resistance training as their sport, in the case of weightlifters, powerlifters, and crossfitters. Subject's 1 repetition maximum (1RM) in the hip thrust exercise was  $211.0 \pm 27.27$  kg.

10 subjects finished the study. One subject did not finish for reasons that were not related to the study. The study was approved by the Ethics Committee of the University of the Basque Country (UPV/EHU). All the subjects signed informed consent, and the study was developed according to the declaration of Helsinki. Anthropometric data of the subjects is displayed in Table 1.

Table 1

	Age (y)	Weight (kg)	Height (m)	Hip thrust 1RM (kg)	80% 1RM
Subject 01	22	82	1,75	235	188
Subject 02	33	78	1,8	229	182,5
Subject 03	25	80	1,92	205	162,5
Subject 04	20	64	1,61	192	152,5
Subject 05	23	114	1,8	245	196
Subject 06	22	75	1,76	235,5	190
Subject 07	22	75	1,82	224,6	180
Subject 08	21	79	1,82	210	170
Subject 09	24	73	1,77	164,5	132,5
Subject 10	23	66	1,71	175	140
<b>Average</b>	<b>23,5</b>	<b>78,6</b>	<b>1,78</b>	<b>211,6</b>	<b>169,4</b>
<b>SD</b>	<b>3,63</b>	<b>13,73</b>	<b>0,08</b>	<b>27,27</b>	<b>21,91</b>

Table 1. Anthropometric and maximal force data

### *Procedure*

Subjects were tested in two separate days, with at least one week of difference between them. In the first day, each subject's 1RM was estimated for the HT, using the Powerlift app for that purpose. The Powerlift app, is a mobile phone app that allows the user to estimate the 1RM of a subject in certain exercises based on the velocity of the barbell. This helped to avoid any kind of potential risk that lifting high loads involve. The first session was also used as a familiarization session, in which investigators gave subjects tips about how to correctly perform the HT and the GB. Specifically, subjects were instructed to lift the bar perfectly horizontal, with the aim of avoiding measurement errors when digitalizing the bar marker. They also filled a questionnaire about their training status, health and other relevant information. On the second day, subjects performed a warm up equal for all of them, involving HT and GB exercises, with lower loads. A barbell, a set of disks, a pad to protect de abdominal and pubis area, and an exercise bench were used for the study. An active LED marker was placed at the end of the barbell of the side that was going to be filmed. After that, subjects performed 3 consecutive repetitions of HT and GB exercises in a randomized order with the 80% of the 1RM of the hip thrust exercise estimated the previous day. Recovery time between exercises was at least of 3 minutes.

### *Materials and data analysis*

A Casio Exilim EX-F1 digital camera with a sampling rate of 300 Hz was used to film both exercises. The videos were digitalized using the Kinovea 8.15 video analysis software to track the bar's endpoint 2D position. Data was analyzed using Microsoft Excel 2016 and VBA programming language to calculate bar's position, velocity and acceleration. Raw data was filtered using a fourth-order zero-lag Butterworth low pass filter, at a cut-off frequency of 10 Hz.

The assessed variables were: Time (T) of the concentric phase, measured in seconds; Horizontal displacement (DisplHor), measured in centimeters, was the sum of all the forward and backward displacements occurring in the horizontal axis; Vertical displacement (DisplVert), measured in centimeters, was the sum of all the upward displacement occurring in the vertical axis; Total displacement (DisplTot), measured in centimeters, was the sum of instantaneous linear displacements in the 2D space; Displacement vector magnitude (DisplVectMag), measured in centimeters, was linear distance between the initial and final bar positions; Displacement vector angle (DisplVectAng), measured in degrees, was the angle formed between the initial and final bar positions with respect to the horizontal axis; Displacement vector index (DisplVectIndex) is an adimensional ratio between DisplVectMag and DisplTot that ranges from 0 to 1 and is calculated as follows:

$$\text{DisplVectIndex} = \frac{\text{DisplVectMag}}{\text{DisplTot}}$$

Vertical positive impulse (ImpPosVert), measured in Newtons per second, is the positive area under the vertical force / time curve, and calculated using the trapezoidal rule. The vertical force was calculated knowing the mass of the bar for each subject and the measured vertical acceleration plus the gravity force; Horizontal total impulse (ImpTotHor), measured in Newtons per second, is the total area under the horizontal force / time curve, and calculated using the trapezoidal rule. The horizontal force was calculated knowing the mass of the bar for each and the measured horizontal acceleration; Total impulse (ImpTot), measured in Newtons per second, was the sum of instantaneous linear impulses in the 2D space.



All the variables were measured only in the concentric phase of both exercises, from the bar's initial vertical movement to its maximal vertical position.

### Statistical analysis

Data were checked for normality using a Saphiro-Wilks test and for homoscedasticity with a Levene's test. The variables that passed both criteria were assessed with a paired Student's T-test, and the others with a Wilcoxon's test. Statistical significance was set at  $p \leq 0.05$ . Cohen's d was calculated to measure the effect sizes,  $ES < 0.3$  was considered small,  $ES < 0.5$  was considered medium, and  $ES \geq 0.8$  was considered big.

## Results

Results are displayed in Table 2.

Table 2

	HT (mean $\pm$ SD)	GB (mean $\pm$ SD)
<b>Time (s)</b>	0,8 $\pm$ 0,14 *	0,58 $\pm$ 0,07
<b>DisplHor (cm)</b>	11,47 $\pm$ 3,74	9,19 $\pm$ 3,35
<b>DisplVert (cm)</b>	35,65 $\pm$ 3,4 *	15,45 $\pm$ 4,82
<b>DisplTot (cm)</b>	39,36 $\pm$ 4,03 *	19,22 $\pm$ 5,63
<b>DisplVectMag (cm)</b>	36,68 $\pm$ 3,51 *	17,84 $\pm$ 5,42
<b>DisplVectAng (deg)</b>	102,18 $\pm$ 6,32 *	61,79 $\pm$ 11,08
<b>DisplVectIndex (°)</b>	0,93 $\pm$ 0,05	0,92 $\pm$ 0,04
<b>ImpPosVert (Ns)</b>	1315,28 $\pm$ 300,34 *	940,65 $\pm$ 93,59
<b>ImpTotHor (Ns)</b>	107,04 $\pm$ 28,84	83,37 $\pm$ 26,53
<b>ImpTot (Ns)</b>	1422,11 $\pm$ 321,59 *	1024,02 $\pm$ 105,48

\* Statistically significant differences between Ht and GB.

Table 2. Mean  $\pm$  SD for 10 measured variables

The time needed to perform HT was larger than for the GB (0.8 vs. 0.58 s)(Figure 3). The three displacement variables were larger for HT (Horizontal 11.47 vs. 9.19 cm; Vertical 35.65 vs. 15.45 cm; Total 39.36 vs. 19.22 cm)(Figure 1)The displacement vector magnitude and angle were also larger for HT (36.68 vs. 17.84 cm; 102.18 vs. 61.79 deg) (Figure 2).Regarding impulses, we only found differences in positive vertical impulse and total impulse (1315.28 vs. 940.65 Ns; 1422.11 vs. 1024.02 Ns)(Figure 4)There were no statistical differences in Horizontal displacement(Figure 1), horizontal total impulse, and

vector-displacement index(Figure 3).

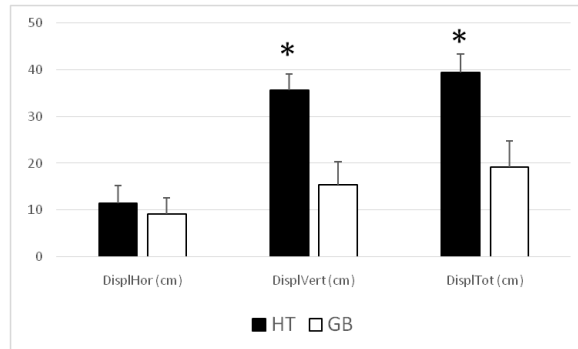


Figure 1. Horizontal, vertical and total displacement of the bar.

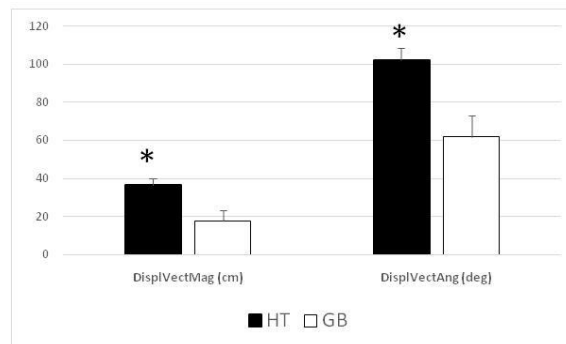


Figure 2. Displacement vector magnitude(cm) and angle (deg).

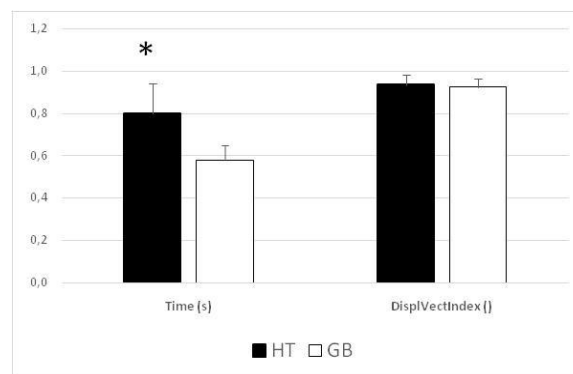


Figure 3 Time and Vector-displacement index.

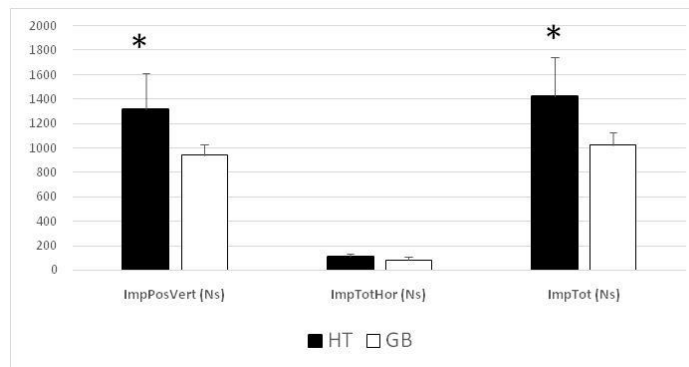


Figure 4. Vertical positive impulse, horizontal total impulse, and total impulse

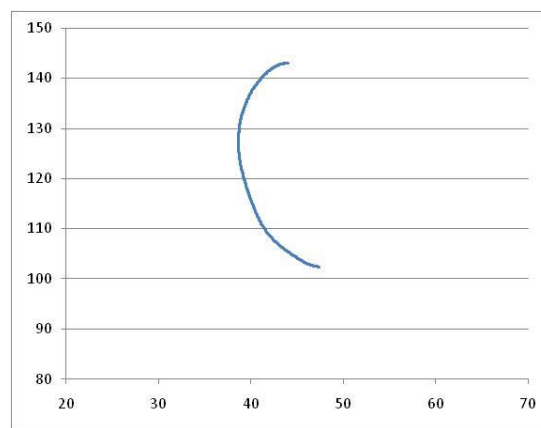


Figure 5. Barbell displacement in the horizontal and vertical axis

## Discussion

The main objective of this study was to compare a series of biomechanical variables between HT and GB. As suspected, the time that it took the subjects to perform the concentric phase of the HT, was higher than the time subjects needed to do the same phase in the GB. This may be caused mainly by the larger angular displacement of the hip joint. This is also reflected in the displacement results, with the total displacement of the hip thrust being the double of the total displacement of the GB (Figure 1). Vertical displacement is also more than double in the HT, which is in turn more significant because of the added resistance of the gravity. This large difference alone could explain the higher loads that can be lifted in the GB. Although the increased displacement

in HT was no surprise, we must be concerned about the effect that the differences these two values have on an athlete's training. Time and displacement are two variables of paramount importance for the correct management of the athlete's training. However, we made a revision of the scientific literature of the barbell hip thrust, and realized that just one study mentioned time of the concentric phase, and even if it analyzed various kinematic variables, it did not refer to the bar displacement as such (Bezodis et al., 2017). Nevertheless, the importance of time and displacement is easy to demonstrate, as there is plenty of research related to them. Time Under Tension (TUT) is a key variable for muscle hypertrophy (Gentil et al., 2006; Mikesky et al., 1989), and relies both on the time the athlete spends applying force against the bar and the RoM in a specific exercise. Regarding strength gains, displacement and time are also accepted as valuable variables, since in recent years intensity and volume are being quantified via measuring barbell's velocity (González-Badillo & Sánchez-Medina, 2010; Sánchez-Medina & González-Badillo, 2011; Sánchez-Moreno et al., 2017).

In addition, the assessment of the horizontal displacement could make us consider a key parameter of the technique, considering that HT is believed to have an almost vertical trajectory, whilst GB displacement is supposed to have a larger horizontal component. However, if we look at the horizontal displacement, it emerges that there is the same amount of horizontal displacement in both exercises ( $11,47 \pm 3,74$ , and  $9,19 \pm 3,35$  cm, respectively). This can be explained considering the particularities some lifter's technique have when performing the HT. There is a clear trend towards performing a horizontal movement at the very beginning of the concentric phase (Figure 5). We hypothesize that this movement might be an unconscious strategy of the lifters to lift the weight more easily by taking advantage of the horizontal inertia that this movement creates. The start of the repetition was considered as soon as a movement was recorded in the vertical axis, from a totally stopped position, and it was considered finished when the movement in the vertical axis ended. In this frame, even if there are inter-subject differences when lifting, all the trajectories analyzed showed a clear "arch" pattern in the hip thrust (Figure 5). This particularity shows new aspects of this exercise that must be taken into

consideration by coaches when choosing the HT for their training session. Regarding running performance, movement in the horizontal axis may involve the HT being less specific of their competition movement, even though it has benefits for running performance(Contreras et al., 2017). Therefore, more research is needed to fully understand the implications of slightly different techniques when performing HT and GB exercises.

Referring to the displacement vector, we analyzed the two variables compounding it: its magnitude (linear displacement) and its angle. The differences between them were significant (Figure 2), and their analysis rises many new questions. As expected, the HT vector magnitude was twice as big as the GB's ( $36.68 \pm 3.51$  vs  $17.84 \pm 5.42$  cm). Surprisingly though, the angle of the HT displacement vector is not completely vertical ( $102.18 \pm 6.32$  deg) which makes us question, once again, the supposed verticality of the hip thrust exercise. A probable reason why this happens is the fact that in the free-weight hip thrust, there is no movement restriction. Because of this, movement happens also in the horizontal axis. The muscular implications that this may have are unknown. From previous literature, however, we can state that the barbell hip thrust elicits higher EMG values for the Gluteus Maximus than other well-known exercises like the back squat, other hip thrust variations, barbell deadlift and hex bar deadlift(Andersen et al., 2018; Contreras et al., 2015, 2016).

The GB displacement vector angle was  $61.79 \pm 11.08$  deg. This was an expected result, and it can partly explain the reason why athletes lift more weight in the GB than in the HT. The lifting trajectory is not totally opposed to the force of gravity (at least it is less opposed than in the hip thrust exercise), and this allows more weight to be lifted with the same force, or less force needed to move a given weight, in comparison to a force vector directly opposed to the gravity.

As we mentioned in the introduction, this is the first time the vector-displacement index is used in the scientific literature. The vector displacement index is a novel kinematic indicator that coaches and practitioners can use as a

tool to recognize and classify a given exercise by assessing the way the actual displacement occurs compared to the displacement vector. The displacement vector is a straight line that connects the initial and final positions of the barbell endpoint during a movement. In this context, we will consider the vector from the 2D coordinate point in which the vertical movement begins, to the point in which vertical movement stops. This index ranges from 0 to 1 and expresses numerically the extent to which the actual movement reflects the desired pattern, allowing coaches and practitioners to assess its adjustment in multi-articular exercises. Although a scale for this index is still to be developed, its initial classification is quite simple: the closer the value is to number 1, the higher the adjustment of the bar displacement to its theoretical linear displacement. Interestingly, this index is equal for HT and GB ( $0.93 \pm 0.05$  vs  $0.92 \pm 0.04$ , respectively). This may be due to the similarities existing in the mechanics of both exercises, both consisting in performing a hip extension, that starts lying supine in the floor, with the bar in the pubis area. It may also suggest that the displacement of both exercises adjusts very well to their displacement vector. This is good news for those athletes and coaches willing to train the postero-anterior displacement vector, such as runners. In the specific case of runners, both exercises would be convenient, taking into account the importance of force application when the hip is fully extended (Contreras et al., 2011) and the superior EMG activation found in the Gluteus Maximus when the hip is at  $180^\circ$  extension (Worrell et al., 2001). More research is needed to understand and improve the many different applications this index may have in sports sciences.

We also analyzed a kinetic variable, the impulse. Regarding the vertical impulse, the difference between HT and GB is significant ( $1315.28 \pm 300.34$  Ns and  $940.65 \pm 93.59$  Ns, respectively). This is not surprising considering that there was also a huge difference also in vertical displacement, and provides a basis to state that the HT has larger benefits than the GB, provided that the same load is used. Brughelli et al., (2011) found that as velocity increased, stride length and frequency increased accordingly, but contact time decreased, finding also a high correlation between horizontal forces and increasing running velocities. In conclusion, the HT is a wiser choice than the GB for this kind of athlete.

The same reasoning applies also to total impulse. Nevertheless, in the case of runners, coaches must be cautious, as there are many things to consider. First, hip thrust offers larger displacement, time and impulse, which can be traduced in superior hypertrophic stimulus because of a greater TUT. But, on the other hand, there is a possibility that the GB induces a greater tension when the hip is fully extended. According to Contreras et al. (2011), this is a key moment for running performance and, therefore, GB should also be considered in training programs. Hence, future research should assess the implications of performing the GB with a load that elicits an equivalent vertical impulse than the HT.

### **Practical applications**

Our results confirm that the hip thrust and the GB have clearly different biomechanical characteristics. We have mostly analyzed kinematic variables, and we conclude that the hip thrust is superior to GB in many aspects. Its larger displacement, both vertical and total, make this exercise more interesting with regards to sports that require strength being applied from smaller hip angles or higher RoMs. It is worth to note that the hip thrust exercise has larger vertical positive and total impulse, suggesting that it has superior properties for sports in which large amounts of force per unit time have to be applied, i.e. weightlifting. It is also known that the hip thrust has the greatest extensor moment when the hip is at approximately 90° (Bezodis et al., 2017), which is a very good argument in favor of the hip thrust in that kind of sports. Nevertheless, Worrell et al. (2001) found that EMG activation is higher in the Gluteus Maximus when the hip is totally extended, which suggest that the possibility that the GB offers to place a higher mechanical tension when the hip is close to full extension may be better suited to achieve a larger hypertrophic stimulus in this muscle, taking into account the role that the mechanical tension has in the muscle hypertrophy (Schoenfeld, 2010).

Regarding the HT, we suggest to maintain the trajectory as vertical as possible and the vector-displacement index as close to 1 as possible, so that the main actuators for the bar acceleration are the hip extensor muscles. This way, athletes can also focus more accurately on the hip extensors, instead of

facilitating hip extensors' duty by creating a previous inertia. This would, in turn, make the athlete lift more weight, but without providing any benefit for the training of hip extensors. For the same reason, avoiding to "rebound" the barbell between the eccentric and the concentric phases is recommended. A 1" rest between repetitions would avoid any ease to perform the concentric phase, and would allow the athlete to better control the barbell's movement, while maintaining a considerable metabolic stress.

Referring to the GB, athletes looking for a new stimulus for the gluteus maximus, in order to avoid a stalemate in muscle hypertrophy, could benefit from using this exercise. However, this kind of use should be sporadic, because its prolonged practice may carry adaptations that are not so interesting for athletes that seek hypertrophy. In addition, GB is also interesting for those practitioners looking for a high amount of force application close to hip lockout, as its RoM is very small and very near to full hip extension. As a conclusion GB may be a good choice to emphasize strength gains in this specific RoM.



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## Appendix 1: Informed consent

The subjects had to sign this document in order to take part in the study

### CONSENTIMIENTO INFORMADO

TÍTULO DEL ESTUDIO: EFECTOS BIOMECÁNICOS DEL HIP THRUST Y EL  
GLUTE BRIDGE SOBRE LOS EXTENSORES DE CADERA

INVESTIGADOR PRINCIPAL:

Nombre: ENEKO FERNÁNDEZ PEÑA

Departamento: Educación Física y Deportiva

Centro: Facultad de Educación y Deporte, UPV/EHU (España)

INVESTIGADOR DE REFERENCIA:

Nombre: AITOR ZABALETA KORTA

E-mail: azabaleta031@ikasle.ehu.eus

Tf: 688636299

Yo....., mayor de edad, con DNI:

.....

Declaro que:

- He leído la hoja de información que se me ha entregado.
- He podido hacer preguntas sobre el estudio.
- He hablado con AITOR ZABALETA KORTA sobre el estudio.
- He recibido suficiente información sobre el estudio.
- Comprendo que mi participación es voluntaria.
- Comprendo que puedo retirarme del estudio:
  1. Cuando quiera
  2. Sin tener que dar explicaciones.
  3. Sin que esto suponga represalias de ningún tipo.

- Comprendo que tengo derecho a conocer los resultados y que podré acceder a ellos solicitándoselos a AITOR ZABALETA KORTA.
- Comprendo que tengo derecho a elegir qué debe hacerse con mis datos obtenidos hasta el momento (destrucción o anonimización de las muestras, o su conservación), informando de ello a AITOR ZABALETA KORTA.
- Participo libremente en el estudio y doy mi consentimiento para el acceso y utilización de mis datos en las condiciones detalladas en la hoja de información.
- Doy mi consentimiento para que me graben durante el estudio:  
Si   
No

Y para que así conste firmo el presente documento en

..... a .....

Firma del participante:	Firma del investigador:
Nombre:	Nombre: AITOR ZABALETA KORTA
DNI:	DNI: 72535588M

## Appendix 2: Information sheet

A sheet that was given to the subjects to inform them about the intervention.

### HOJA DE INFORMACIÓN

<b>TÍTULO DEL ESTUDIO:</b> EFECTOS BIOMECÁNICOS DEL HIP THRUST Y EL GLUTE BRIDGE SOBRE LOS EXTENSORES DE CADERA	
<b>INVESTIGADOR PRINCIPAL:</b>	
Nombre: ENEKO FERNÁNDEZ PEÑA Departamento: EDUCACION FISICA Y DEPORTIVA Centro: FACULTAD DE EDUCACIÓN Y DEPORTE, UPV/EHU	
<b>INVESTIGADOR DE REFERENCIA:</b>	
Nombre: AITOR ZABALETA KORTA E-mail: azabaleta031@ikasle.ehu.eus Tf: 688636299	

### INTRODUCCIÓN

Nos dirigimos a usted para informarle sobre un estudio de investigación en el que se le invita a participar. El estudio ha sido aprobado por el Comité de Ética para las Investigaciones relacionadas con Seres Humanos (CEISH) de la Universidad del País Vasco (UPV-EHU). Nuestra intención es tan solo que usted reciba la información correcta y suficiente para que pueda evaluar y juzgar si quiere o no participar en este estudio. Para ello lea esta hoja informativa con atención y nosotros le aclararemos las dudas que le puedan surgir después de la explicación. Además, puede consultar con las personas que considere oportuno.

### PARTICIPACIÓN VOLUNTARIA

Debe saber que su participación en este estudio es voluntaria y que puede decidir no participar o cambiar su decisión y retirar el consentimiento en cualquier momento, sin que por ello se derive en consecuencias negativas para usted ni se produzcan represalias directas o indirectas por su decisión.

### DESCRIPCIÓN GENERAL DEL ESTUDIO:

El objetivo del estudio es evaluar el efecto que dos ejercicios de acondicionamiento de uso común en los gimnasios tienen sobre los extensores de la cadera. Para ello, se medirán algunas variables biomecánicas que ayudarán a esclarecer el efecto de los ejercicios sobre los extensores de la cadera.

Los sujetos deberán acudir al edificio de la sección deporte de la Facultad de Educación y Deporte del campus de Álava, sita en Portal de Lasarte 71, 01007 de Vitoria-Gasteiz, donde se encuentra el gimnasio de la UPV/EHU del campus de Álava. Se le solicitará acudir a este centro 2 días diferentes para que el equipo investigador tome los datos necesarios para el desarrollo de la investigación. El primer día se realizará una familiarización con el procedimiento que se llevará a cabo, y los investigadores se asegurarán de que la ejecución técnica es la correcta. Por otro lado, ese mismo día, se realizará un test submáximo para determinar cuál es el peso máximo que un sujeto puede levantar en el ejercicio de Hip Thrust, que más tarde con otros datos que se tomarán ese día servirá también para saber cuál es el peso máximo que el sujeto puede levantar en el ejercicio Glute Bridge de forma indirecta. El tiempo estimado de la primera sesión es de aproximadamente 75-90'.

En el segundo día, se pedirá a los sujetos que acudan al mismo sitio y después de un calentamiento estándar, guiado por los investigadores, se pedirá a los sujetos que realicen 3 repeticiones de Hip Thrust y 3 repeticiones de Glute Bridge con el 80% del peso máximo que dicho sujeto pueda levantar, calculado la sesión anterior. Las tres repeticiones serán grabadas, y unos marcadores activos serán colocados en articulaciones clave para la grabación. El orden de los ejercicios será diferente entre los sujetos.

#### BENEFICIOS Y RIESGOS DERIVADOS DE SU PARTICIPACIÓN EN EL ESTUDIO

Los riesgos de la aplicación de los test implicados en esta investigación son prácticamente equiparables a los de una sesión normal de entrenamiento. El beneficio esperado para los participantes en el estudio es el conocimiento de algunas variables biomecánicas aplicadas a un ejercicio que suelen ejecutar en sus entrenamientos normalmente.

#### CONFIDENCIALIDAD

Los datos personales que nos ha facilitado para este proyecto de investigación serán tratados con absoluta confidencialidad de acuerdo con la Ley de

Protección de Datos. Se incluirán en el fichero de la UPV/EHU de referencia “INB - EFECTOS BIOMECÁNICOS DEL HIP THRUST Y EL GLUTE BRIDGE SOBRE LOS EXTENSORES DE CADERA” y sólo se utilizarán para los fines del proyecto. Es posible ceder datos del proyecto a grupos colaboradores, pero en ningún caso figurarían datos que lo pudieran identificar.

Puede consultar en cualquier momento los datos que nos ha facilitado o solicitarnos que rectifiquemos o cancelemos sus datos o simplemente que no los utilicemos para algún fin concreto de esta investigación. La manera de hacerlo es dirigiéndose al Responsable de Seguridad LOPD de la UPV/EHU, Rectorado, Barrio Sarriena, s/n, 48940-Leioa-Bizkaia.

Para más información sobre Protección de Datos le recomendamos consultar en Internet nuestra página web [www.ehu.eus/babestu](http://www.ehu.eus/babestu)”.

#### COMPENSACIÓN ECONÓMICA

Su participación en el estudio no le supondrá ninguna compensación económica.

#### OTRA INFORMACIÓN RELEVANTE

Cualquier nueva información referente al estudio que se descubra durante su participación y que pueda afectar a su disposición a participar en el mismo, le será comunicada por su investigador de referencia lo antes posible.

Si usted decide retirar el consentimiento para participar en este estudio, ningún dato nuevo será añadido a la base de datos y, puede exigir la destrucción de todos los datos identificables previamente retenidos.

También debe saber que puede ser excluido del estudio si los investigadores del estudio lo consideran oportuno, ya sea por motivos de seguridad, por cualquier acontecimiento adverso que se produzca durante el estudio o porque consideren que no está cumpliendo con los procedimientos establecidos. En cualquiera de los casos, usted recibirá una explicación adecuada del motivo que ha ocasionado su retirada del estudio.



