A comparison between activation of pectoralis major and triceps brachii using different grip widths in the bench press

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Bachelor's Thesis in Exercise Biomedicine, 15 credits

Halmstad 2017-05-22
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Halmstad University School of Business, Engineering and Science

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Abstract

Turnstedt, M. – **Background.** Resistance training has many positive effects on the human body and can be beneficial for people all ages. The bench press exercise is a commonly used exercise that targets many upper body muscles such as pectoralis major, triceps brachii, deltoideus, serratus anterior and the abdominal muscles. Variations of the bench press exercise are common where grip width variations are supposed to largely impact the muscles targeted. Some research has been done to accurately decide whether these theories are true, however more research is needed to definitely decide the effect on muscle activity of grip width in bench press. **Aim.** The aim of this study was to compare the muscle activity with surface electromyography (EMG) in pectoralis major and triceps brachii between wide, regular and narrow grip width in the bench press exercise. **Method.** 21 healthy males (23.19 ±2.5 years) volunteered to participate in this study. The raw EMG data from the bench presses were converted to root mean square and then average root mean square. The mean average muscle activation (in µV) was divided by a maximum voluntary isometric contraction (MVIC) and expressed as percent MVIC (%MVIC). **Result.** The results of the present study showed a statistically significantly higher muscle activation in the wide grip width compared to the narrow grip width in pectoralis major (p<0.005) and a statistically significantly higher muscle activation could be found in the narrow grip width compared to the wide grip width in triceps brachii (p<0.033). **Conclusion.** Practical use of this study is to use the narrow grip width in bench press when increased triceps brachii strength and size is desired and if increased pectoralis major strength and size is desired the wide grip bench press exercise is preferable.
Abstrakt

Turnstedt, M. – Bakgrund. Styrketräning har många positiva effekter på kroppen och är bra för människor i alla åldrar. Bänkpress är en vanlig övning som tränar många Muskler i överkroppen såsom pectoralis major, triceps brachii, deltoideus, serratus anterior samt magmusklerna. Det är vanligt att utöva olika variationer av bänkpress där greppvidden sägs påverka vilka muskler som används. Viss forskning har gjorts för att avgöra om det finns sanning i dessa teorier, men mer krävs för att säkerställa detta. Syfte. Syftet med denna studie var att jämföra muskelaktivitet med yt-elektromyografi (EMG) i pectoralis major samt triceps brachii med smalt, medel och brett grepp i bänkpress. Metod. 21 friska män (23.19 ±2.5 år) deltog frivilligt i denna studie. Den råa EMG datan från bänkpressövningarna konverterades till det kvadratiska medelvärdet och sedan till genomsnittligt kvadratiskt medelvärde (RMS). Medelaktiviteten (i µV) delades med det maximala frivilliga isometriska kontraktionsvärdet (MVIC) och uttrycktes i procent MVIC (%MVIC). Resultat. Resultatet i studien visade på en statistiskt signifikant högre muskelaktivitet i pectoralis major i bänkpress med brett grepp jämfört med smalt grepp (p<0.005) samt en statistiskt signifikant högre muskelaktivitet i triceps brachii i bänkpress med smalt grepp jämfört med brett grepp (p<0.033). Konklusion. Praktisk användning av denna studie är att använda bänkpress med smalt grepp om ökad triceps brachiistyrka och hypertrofi är önskvärd samt bänkpress med brett grepp om ökad pectoralis majorstyrka och hypertrofi är önskad.
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1. Background

Resistance training for muscular hypertrophy and strength is of major importance to a number of professional and recreational athletes and can be very time consuming. To make this process more effective, training with specific muscle targeting is used. A classic example of this is the usage of narrow and wide grip width bench press where the narrow grip width bench press exercise is supposed to target the triceps brachii muscle more and the wide grip width bench press exercise is supposed to target the pectoralis major more (Likness, 2004). However, scientific evidence is scarce, thus further investigation of this popular theory is of interest.

1.1. Resistance training

Physical training is generally seen as positive for the human body. From the general public’s point of view more emphasis is usually put on cardiovascular training but resistance training is gaining in popularity and has shown many positive effects for the human body. Resistance training can for example prevent or largely limit the negative effects of osteoporosis, sarcopenia and lower-back pain (Winett & Carpinelli, 2001). In addition, physiological problems such as insulin resistance, resting metabolic rate and blood pressure among many other things can improve from a small dose of resistance training (Winett & Carpinelli, 2001). These effects of resistance training can help populations of all ages, and especially those prone to health complications previously mentioned (Zavanela et al., 2012). Physiological changes to a resistance training program can come fairly quickly, where the quick rise in strength from muscular contractions in the first two weeks are mainly due to neurological adaptations and later muscular adaptations (Folland, & Williams, 2007).

1.2. Muscular contraction and adaption

1.2.1. Muscle contraction

Resistance training uses muscular contractions to move the muscles and do work. In order to make the muscles contract several actions in the body need to occur. First the cerebral cortex
in the brain sends out a stimulus to create muscle activity. The process of muscular contraction starts by an action potential being sent to the muscle via a motor neuron which emits the neurotransmitter acetylcholine from its vesicles in the terminal axon of the nerve (Cardinale, Newton & Nosaka, 2011). The acetylcholine triggers an action potential in the muscle fiber which makes it down to the t-tubules then in turn causes calcium to be released from the sarcoplasmic reticulum. The calcium binds to associated proteins on the thin actin filaments which exposes sites for the thick myosin filaments to bind to actin and start the cycle according to the sliding-filament model. During a muscle contraction the myosin heads climbs up the actin filament using adenosine triphosphate (ATP) which shortens the sarcomere and thus the muscle creates movement. When releasing tension in the muscle the action potential ends and calcium is actively removed back into the sarcoplasmic reticulum and once again the troponin blocks the binding sites on the myosin and the muscle relaxes (Campbell, 2015). This process occurs in every muscular contraction during resistance training and gets more efficient eventually through muscular adaptation.

1.2.2. Muscular adaption

Resistance training puts the body and muscles under an increased stress which forces it to better prepare for higher physical demands in a few different ways. It can create a hypertrophic and/or hyperplastic response where an increase in cross-section area in the muscle occurs due to a myofibrillar size and/or number increase (Kelly, 1996). Other adaptations from resistance training are strengthening of tendons, neurological adaptations and changes in muscle fiber type (Cardinale, Newton & Nosaka, 2011). Progressive resistance training is the general method for muscular development. Over time the body adapts to the stimulus forced upon it and as a result hypertrophy and/or hyperplasticity responses are created which means that this stimulus will no longer be enough to create development. Therefore, new and higher stimuli needs to be applied which is made through the overload principle (Cardinale, et al., 2011). The level of activation needed for muscular adaptations to occur during a training program is approximately 40-60% of maximum voluntary isometric contraction (MVIC) (Konrad 2005). The specificity principle states that specific training leads to specific adaptations in the muscle, this due to the muscles plasticity which helps it adapt to the new stress (McArdle, Katch & Katch, 2015). The specificity principle depends on the local muscular activation which can be altered though different exercises and can be measured though electromyography (Wakahara, Fukutani, kawakami & Toshimasa, 2013).
1.2.3. Electromyography

The activity level in the muscles during the different types of resistance training can be measured through electromyography (EMG). EMG is a method used to investigate the neuromuscular activity in the muscles through measurement of electrical impulses which form action potentials propagating along the muscle membrane activating muscle contractions. In EMG, the total of all electrical impulses made by the active motor units in the area of the electrodes are measured (Farina, Merletti & Enoka, 2004). Different kinds of EMG methods exist and the two most common ones are fine-wired intra muscular EMG and surface EMG. Intra muscular EMG requires insertion of needles into the muscle belly with the help of ultrasound. This method is both expensive and needs highly skilled personnel to perform compared to the cheaper and more available surface EMG. Surface EMG is both more cost and time effective and studies have shown that for superficial muscles the validity and reliability are similar to those from intra muscular EMG on a variety of muscles (Marshall & Murphy, 2003). However, for deeper muscles fine wire EMG is the preferred method. Physiological “cross talk” is a problem with surface EMG where neighboring muscles may elicit EMG signals, however this should not interfere more than 10-15% of total signal contents if at all (Konrad, 2005). EMG can be normalized against an MVIC to know the percent of the total capacity of muscle activity that is used in a specific movement or task (Konrad, 2005).

1.3. The bench press

Upper body muscular strength is of great importance in many sports and activities, and optimizing resistance training strength gains is often a priority for both coaches and athletes. The bench press exercise is one of the most frequently used upper body resistance exercise for its all-round ability to activate upper body muscles. Many methods exist to train bench press to achieve different purposes. For example, eccentric and isokinetic training had a greater muscle activation during the eccentric phase than auxotonic heavy weight training (Keogh, Wilson & Weatherby, 1999). Eccentric training has shown being more preferable for strength adaption and muscular hypertrophy. (Kelly et al., 2015). However, heavy weight training with
weights up to approximately 6 repetitions maximum produces more power during all phases of the lift (Keogh et al., 1999).

The free weight barbell bench press is performed laying down on a bench while pressing a barbell straight up from the chest. The exercise requires balance in three planes of motion and is also multi jointed which makes it a time effective exercise training many muscles at once (Stastny et al., 2017; Schick et al., 2010). The bench press exercise primarily activates the pectoralis major, anterior deltoid and anterior serratus but it also activates triceps brachii, the abdominal muscles, posterior deltoid and upper trapezius (Calatayud et al., 2014). According to a study the weight lifted during a regular push-up on toes is 64% of total bodyweight (Ebben et al., 2011). This was the weight used during the bench press in the current study because of the easy translation into the push-up exercise and the study that was made parallel to this study which used this percentage as well.

1.3.1. Bench press and electromyography

The bench press is not only multi jointed but also multi plained which means it activates many muscles. A study using EMG compared fixed barbell bench press in Smith-machine vs free weight, to determine which one is preferred. The study found that the medial deltoid was significantly more activated during the lift and they suggested that the free weight is superior the fixed bar bench press due to its greater potential for upper body muscle development because of the larger role played by stabilizing muscles (Schick et al., 2010). Experienced bench press users commonly vary their grip widths depending on the purpose of the training, where anecdotally a narrow grip width has been used for triceps brachii development and a wider grip width for pectoralis major development (Likness, 2004). A study measured muscular activation with EMG during a static bench press hold and found that moving from a wide to narrow grip increased the activation in the triceps brachii and decreased the activation in the pectoralis major (Lehman, 2005). Another bench press study measured muscular activation in the pectoralis major and triceps brachii during horizontal and decline bench press using different grip widths. They found that the clavicular head of the pectoralis major, contrary to the previous study, was more active in the narrow grip press. However, the tricep brachii activation confirmed the findings of the previous study as it showed more activation as the grip width narrowed (Barnett, Kippers & Turner, 1995). A third study measured muscular activation in tricep brachii, trapezius, front deltoid and pectoralis major and found that muscle
activity in the pectoralis major decreased as the grip width narrowed and increased in the tricep brachii (Park et al., 2009).

Despite the bench press being a common exercise and different width grips regularly being used, little research exists on the effect of the different grip width on muscle activity in pectoralis major and triceps brachii when performing a standard dynamic and horizontal bench press with standardized grip widths.

### 1.4. Aim

The aim of this study was to compare the muscle activity with surface EMG in pectoralis major and triceps brachii between wide, regular and narrow grip in the bench press exercise.

The research questions were:
- Is there a difference in muscle activity in the pectoralis major and/or triceps brachii between the three different width bench presses?
- If there is a difference in muscle activity in the pectoralis major and/or triceps brachii, which grip width activates which muscle more?

### 2. Method

#### 2.1. Subjects

This study included 21 male subjects with an average age of 23± 2 years. Inclusion criteria were that the subjects had to have a minimum of 6 months of strength training experience and had to be able to perform 10 strict bodyweight push-ups. Exclusions of subjects were if they had been sick within a week prior to testing or had injuries affecting bench press performance (Lehman, 2005). Social media was used in order to recruit test subjects.

#### 2.2. Testing procedures
2.2.1. EMG

In this study surface electromyography (Mega Electronics Ltd Kuopio, Finland) was used to measure muscle activity. The validity of the method has been investigated previously, where for example, a study on healthy young men tested EMG for validity and how well it measures functional activity in the muscle. Using a cross-correlational analysis they concluded that surface EMG accurately measured muscle activity (Marshall & Murphy, 2003).

For EMG application, the subject was instructed to remove their shirt in order to make the chest and arm on the subject’s right side of the body visible for testing. Palpation was done in order to locate the middle of the muscle belly where the electrodes were placed. Any hair in this area was removed by shaving in order to make sure signals would be measured properly. Thereafter an abrasive and conductive cleaning liquid was used to remove dead skin cells and reduce impedance. Measuring electrodes were applied two cm apart in a central position on the muscle bellies of the triceps brachii and pectoralis major. A reference electrode was applied at a 90 degree angle to each of the two measuring electrodes (Konrad, 2005). The surface electrodes used are pre-gelled for easy application (Ag/AgCl, Blue M-00-s, Ambu A/S, Ballerup, Denmark).

Figure 1  Electrode placement
A maximal voluntary isometric contraction was performed to use as a comparable value when analyzing the data from the bench press exercises (Konrad, 2005). To measure MVIC in pectoralis major and triceps brachii an isometric bench press was used. The subject was asked to lie down under a vertically fixed bar in a Smith-machine with elbows at a 90 degree angle and press upwards isometrically as hard as possible. This was repeated three times for five seconds with one minute resting period in between. These muscle contractions gave a baseline µV value taken from the average maximum contraction in the three repetitions which later was used in the data analysis for the dynamic movements as a maximum reference value (Konrad, 2005). The raw EMG data from the dynamic bench presses were converted to average root mean square (RMS). The mean average muscle activation (in µV) was then divided by the peak average MVIC value and gave a percent MVIC value for each muscle and exercise which was used in the data analysis (Konrad, 2005).

2.2.2. Testing

After the EMG procedures, the subjects’ biacromial width (BiW) was measured in order to know where to grip the bar. Tape was applied to the barbell where the subject was supposed have the index finger to grip the bar. The subjects’ BiW was used in order to individualize and standardize their different grip widths on the barbell. A previous study found that 200% BiW was optimal for creating power and will therefore be called the regular grip in this study (Wagner et.al., 1992). Furthermore, the two other grip widths investigated in thus study was a narrow grip which was 100% BiW and wide grip was 270% BiW (Lehman, 2007).

Thereafter, the subjects performed a standardized warm-up of the muscles studied. This warm-up included two sets of 10 repetitions bench press with the barbell and 5 push-ups with a 2 minute rest period between. After these procedures, the subject had a 5 minute resting period (de Salles et al., 2009; Pincivero, Cramp & Nakamura, 2004). Then the subject performed 5 repetitions of bench press at 64% of body weight using the narrow grip width. After a 2 minute rest the subject performed 5 repetitions using the regular grip width and finally the wide grip width. In order for the repetition to be approved the bar had to touch the chest in the bottom phase and the elbows needed to be locked out in the top phase. For standardization purposes a metronome was used for the subject to keep the same pace when lifting. The metronome had a pace of 40 beats per minute which equals to 1.5 s in the
2.3. Ethical and Social considerations

This study compared muscle activation in the pectoralis major and triceps brachii during wide, regular and narrow grip width bench press using surface-EMG testing. Using surface-EMG included application of electrodes on the subjects’ body which might elicit slight discomfort but will not do any harm. This study followed the ethical principles of the Declaration of Helsinki which discusses all medical research involving human subjects (Declaration of Helsinki, 2013). In brief the subjects were informed of these conditions and were asked to sign the consent form before the testing began (Appendix 1). The subjects were informed that they could at any time end their participation in the project without further implications.

Resistance training has many positive effects on the human body as previously mentioned (Winett & Carpinelli, 2001). For this purpose, the bench press exercise is a great option and interest in the activity of pectoralis major and triceps brachii may be of use for coaches, teachers, professional and recreational athletes. To optimize and make training time efficient is in everyone’s greatest interest. The results of the current study will give a greater understanding of the different width grip bench press exercises and their respective muscle activation. The results will give a scientific basis of which to apply training programs in all parts of the training spectrum (McArdle et al., 2015, p. 502-515).

2.4. Statistical analysis

IBM SPSS Statistics 24 was used to statistically analyze the results. The mean average activation from the three different lifts using narrow, regular and wide grips in the triceps brachii and pectoralis major were compared to the results of the peak average MVIC values giving a %MVIC value. Shapiro-Wilks test was used to check for normality. A majority of the variables were not normally distributed thus non-parametric statistics was used, however mean and standard deviation was used to make comparisons to other studies easier. The Friedman Test was used to determine whether there were any statistically significant
differences, and if a difference at the p<0.05-level was detected, pairwise comparisons were used to investigate further where differences in the average muscle activation in the three grip width bench presses were. The significance level was set to p<0.05.

3. Results

All 21 subjects completed all three sets of different grip width bench press (narrow, regular and wide). There were no drop-outs. The anthropometrical data of the test subjects are shown in table 1, including biacromial width which was used for calculating grip width.

<table>
<thead>
<tr>
<th>Table 1 Subject anthropometrics’</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=21</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Age(years)</td>
</tr>
<tr>
<td>Weight(kg)</td>
</tr>
<tr>
<td>Biacromial width(cm)</td>
</tr>
</tbody>
</table>

3.1. Differences in muscle activity in pectoralis major and triceps brachii

The muscle activity in each of the three grip widths (narrow, regular and wide) in pectoralis major and triceps brachii are shown in table 2 and figure 2. In triceps brachii, a statistically significant increase in %MVIC was found when moving from the wide to the narrow grip width (p=0.033). However no statistically significant differences were found between narrow and regular grip width (p=0.112) nor regular and wide grip width (p=1.000). In pectoralis major, a statistically significant increase was found when moving from the narrow to the wide grip width (p=0.005) but no statistically significant differences were found between narrow and regular grip width (p=0.948) nor between regular and wide grip width (p=0.092)
Table 2 Mean muscle activity in µV and percent MVIC with standard deviation (SD) in the three different grip width bench press exercises

<table>
<thead>
<tr>
<th>Average activation</th>
<th>Pectoralis major</th>
<th>Triceps brachii</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>µV</td>
<td>%MVIC</td>
</tr>
<tr>
<td>Narrow</td>
<td>221.24 ±112.35</td>
<td>39.24 ±19.53</td>
</tr>
<tr>
<td>Regular</td>
<td>249.14 ±111.33</td>
<td>43.14 ±19.53</td>
</tr>
<tr>
<td>Wide</td>
<td>269.38 ±122.33</td>
<td>46.48 ±15.81</td>
</tr>
</tbody>
</table>

Friedman p-value
<br>
<0.05
<br>
<0.05

Post-hoc
<br>
N-R: 0.948
N-W: 0.005
R-W: 0.092
<br>
N-R: 0.112
N-W: 0.033
R-W: 1.000

N= Narrow, R= Regular, W= Wide

Figure 2 Average muscle activation in narrow, optimal and wide bench press in percent MVIC. * indicates statistically significantly higher muscle activity compared to the narrow grip width bench press. ** indicates statistically significantly lower muscle activity compared to the wide grip width bench press.

4. Discussion
The major findings in this study were that the muscle activation in the pectoralis major was statistically significantly higher during the wide grip bench press exercise compared to the narrow grip (p<0.005) whereas for the triceps brachii the muscle activation was statistically significantly lower during the wide grip bench press compared to the narrow grip (p<0.033).

4.1. Result Discussion

The increase in muscular activation in the triceps brachii and decrease in pectoralis major as the grip width narrowed in the bench press exercise in the present study agrees with the findings of Lehman (2005) who also found that the muscular activation in triceps brachii increased and pectoralis major decreased as the grip width narrowed. However, the study by Lehman (2005) used a static hold one inch above the chest and five cm from the lock-out position, whereas the present study measured a dynamic bench press. Furthermore, they used 12 repetition maximum whereas in the present study 64% of bodyweight was used. Barnett et al., (1995) also found that triceps brachii activation was significantly greater during the narrow grip width. However, contrary to the current study, they did not find any differences in muscle activation in the pectoralis major and the different grip widths. They used 100% BiW for narrow grip width and 200% BiW for wide grip width which was narrower than the current study where 270% BiW was used for wide grip width. Furthermore, their lifting pace was two seconds in the eccentric phase where the current study used a pace of 1.5 seconds which could have led to differences in results. The study by Barnett et al., (1995) explained that the increased muscle activation in triceps brachii in the narrow grip width might possibly be due to the higher range of motion in the elbow joint which requires a larger concentric contraction and thereby recruitment of more motor units resulting in a greater muscle activation.

A small study on similarly aged men as the present study by Park et al., (2009) showed similar results to the present study where triceps brachii activation increased and pectoralis major decreased as grip width narrowed. However, details of the study were unavailable due to it being an abstract.

For an increase in strength as previously mentioned at least an EMG activation of 40-60% is required (Konrad, 2005). The average activation of both the triceps and pectoralis major muscles in the current study generally did not meet these activation requirements as seen in
Thus bench pressing the equivalent weight of a push up (64% of bodyweight) is not enough for muscular gains and more weight is required. Wakahara et al., (2013) studied the effects of muscular activation and regional muscle hypertrophy in each session during a training program and found that muscular activation correlates to muscular hypertrophy in that region. The effect of a training program on increases in muscular strength does however strongly depend on the weight lifted compared the 1 repetition maximum (RM) (McArdle et al., 2015). The current study used 64% of body weight which does not compare to how strong the subject is, most other studies used a percentage of 1RM (Barnett et al., 1995; Lehman 2005; Keogh et al., 1999).

4.2. Method discussion

In the current study, the two muscles pectoralis major and triceps brachii activated during the bench press exercise were chosen. These two were chosen due to their simplicity in measuring, greater public interest and have been shown to be more active during the bench press exercise (Stastny, 2017) However other muscles could have been of interest such as the abdominal muscles, latisimus dorsi, biceps brachii and deltoideus (Barnett, Kippers & Turner, 1995; Lehman, 2005; Stastny, 2017).

Inclusion and exclusion criterion were made to protect the subjects from injury and to give results which were to be applicable to the particular population which would be interested in a study of this kind (Lehman 2005). The test group was relatively homogenous (males 19-29) thus making the results applicable mainly to healthy young males. Test of a wider range of people and both sexes could be of interest in order to get more generally applicable results.

The MVIC tests originally used for the pectoralis major and triceps brachii were the fixed bar bench press, which was used in this study, and the wall press as recommended by Konrad (2005). However, lower maximum activation values were found for the triceps brachii in the wall press than in the fixed bar bench press. Therefore the wall press which was supposed to be the triceps brachii specific exercise ignored and the maximum activation values for the triceps brachii were attained from the fixed bar bench press which was supposed to be the pectoralis major specific exercise and used as MVIC instead. If the lower values of the wall press for triceps brachii would have been used, much higher %MVIC values in would have been reported. The subjects also reported difficulties in performing maximal contractions in
the MVIC exercise which may give misleading %MVIC values. In the future, alternative exercises in these MVIC measurements could possibly increase reliability, however, we are aware that for comparison between different studies it is imperative that the same MVIC are used according to standard guidelines and that instead the guidelines are in need of being updated (Konrad, 2005; Seniam (n.d.).

The measurements were made in the same day with resting periods of five minutes after MVIC and two minutes after each of the three bench press sets starting with the narrow, followed by the regular then the wide grip width. The exercises were not randomized, however, according to de Salles et al. (2009) the current resting period should be sufficient with the weights used in order to be able to complete multiple sets. Pincivero, Crampy & Narunakara (2004) explains that if resting periods are too short during resistance training a greater neuromuscular response will be measured in the EMG. Had we randomized the different grip widths, this concern would have been eliminated.

In addition to the results found in this study, perhaps a subjective scale could be of interest. How the subjects perceived the exercises and how they felt the activation in the different muscles was affected by the different widths and compared to the MIVC exercise. The Borg scale of perceived exertion could possibly have given the study additional information to weigh into the discussion.

5. Conclusion

In conclusion, the wide grip width bench press exercise activated the pectoralis major statistically significantly more than the narrow grip width and the narrow grip width activated the tricep brachii significantly more than the wide grip width. The other grip width comparisons did not show any significant differences. The general findings of this study may be of practical use when increased tricep brachii strength and size is desired the narrow grip width bench press is preferable to the other two grip widths. If increased pectoralis major strength and size is desired, the wide grip width bench press is preferable to other two grip widths. Future studies could investigate this further by using different loads, paces and grip widths.
6. References


Appendix 1

Information and consent form all subjects had to sign before participation in the current study

Informationsblad för:
Jämförelse av bänkpress och armhävning med EMG samt jämförelse av olika grepp vid bänkpress med EMG

Hej!
Vi är två studenter från Halmstad Högskola och går på utbildningen Biomedicin med inriktning fysisk träning. Vi ska påbörja vårt examensarbete och som del i detta har vi valt att genomföra tester där vi ska titta på muskelaktivitet vid olika variationer av vanliga styrketräningsövningar och vi undrar om du är intresserad att vara del av vår undersökning.

Syfte: Syftet med denna studie är att jämföra muskelaktivitet av bröst- och triceps i övningarna bänkpress och armhävning och dels att jämföra muskelaktivitet i samma muskler vid olika bredder i övningarna bänkpress


Nytta: Studien siktar på att kunna assistera till ett mer effektivt träningsupplägg för såväl erfarna lyftare som för amatörmotionärs. För dig som deltagare i studien kommer du att få delta i en vetenskaplig studie och vara närvarande vid kritiska punkter för studierna. Denna information kan vara nyttig att veta om du skulle vilja delta i andra framtida studier eller siktar på att genomföra liknande studie själv. Du kommer även få inblick i hur din egen kropp arbetar vid bänkpress och även armhävning, hur just dina muskler arbetar under övningarna.

Vikterna som används till bänkpressen kommer vara 64% av kroppsvikten vid testtillfället och kan medföra risker om du inte orkar lyfta vikten allt efter som testen pågår. Dock kommer en testledare vara beredd att hjälpa till om detta skulle vara fallet. Ett obehag kan även komma att uppstå vid testtillfället då testledare behöver palpera (känna efter var muskeln är) på dig samt att delar av musklerna kommer även behöva rakas och torkas av vilket kan medföra ett visst obehag.


Deltagande: Deltagande i denna studie är fullständigt frivillig och man har rätt att när som helst, utan förklaring, avbryta sin medverkan i studien. Vid eventuell avbrytning av medverkan i denna studie kommer inte bemötandet och omhändertagandet av dig att påverkas. Vid avbruten medverkan kommer eventuella resultat och uppgifter som dokumenterats om dig att förstöras.

Testledare och ansvariga för denna studie:

<table>
<thead>
<tr>
<th>Namn</th>
<th>Telefonnummer</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Turnstedt</td>
<td>xxx</td>
<td><a href="mailto:xxx@hotmail.com">xxx@hotmail.com</a></td>
</tr>
<tr>
<td>Christopher Danielsson</td>
<td>xxx</td>
<td><a href="mailto:xxx@gmail.com">xxx@gmail.com</a></td>
</tr>
</tbody>
</table>

Handledare på Högskolan i Halmstad:

<table>
<thead>
<tr>
<th>Namn</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte Olsson</td>
<td><a href="mailto:xxx@hh.se">xxx@hh.se</a></td>
</tr>
</tbody>
</table>
Samtycke
Nedan ger du ditt samtycke till att delta i den studie som undersöker muskelaktivering vid övningarna bänkpress och armhävning. Läs gärna igenom informationen för studien noggrant och gärna flera gånger. Om du vill delta ger du ditt medgivande till deltagande genom att signera med namnteckning nederst på denna sida.

- Jag bekräftar att jag har tagit del av denna skriftliga information om forskningsstudien och förstår vad den innebär.
- Jag har fått ställa frågor, och jag vet vem som är ansvarig för studien om jag skulle vilja ställa fler frågor.
- Jag accepterar att mina personuppgifter hanteras på det sätt som beskrivits
- Jag förstår att jag kan avbryta min medverkan i studien när som helst utan anledning och efterföljande konsekvenser.
- Jag intygar härmed att jag har läst det informerade samtycket samt tagit del av informationen kring studien. Jag förstår vad deltagande i denna studie innebär och ställer upp frivilligt.

……………………………………... ………………………………………...
Datum Deltagarens namnteckning Namnförtydligande

……………………………………………………………………………………
Deltagarens födelsedatum (åtta siffror), månad och dag

Undertecknad har gått igenom och förklarat studiens syfte för ovanstående deltagare samt erhållit deltagarens samtycke. Deltagaren har även fått en kopia av av det informerade samtycket.

……………………………………... ………………………………………...
Datum Namnteckning Namnförtydligande
Max Turnstedt