MUSCLE report

volume 7 issue 8

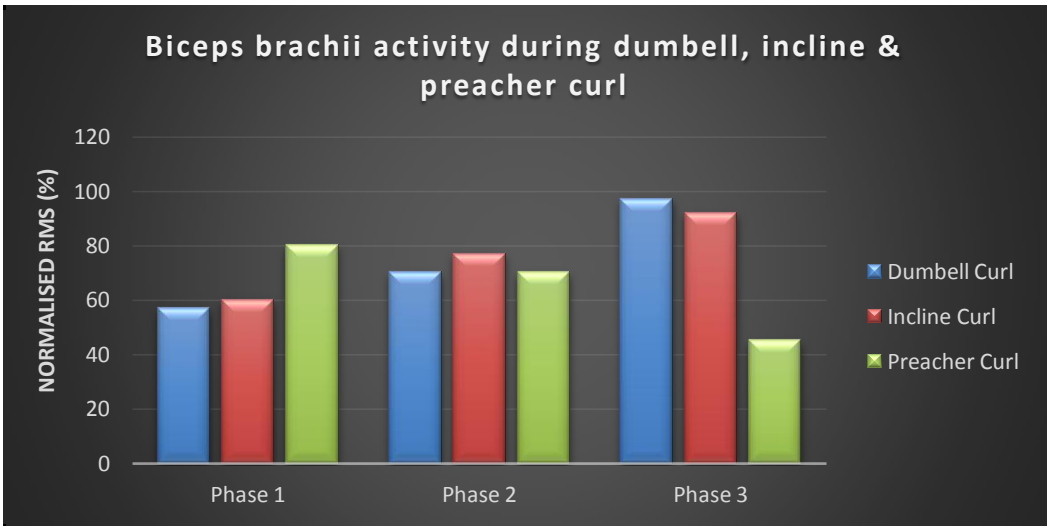
The latest Scientific Discoveries in the Fields of Resistance Exercise, Nutrition and Supplementation.

1 exercise, 2 different ways = 1 result

Free weights have the advantage of allowing you to perform an exercise in a variety of positions. By changing from a standing posture to a sitting or lying one (or vice versa) you can completely change the feel of the movement. This means you can alter the stress on the targeted muscle simply by changing the position of the body during the exercise. Athletes use this to their advantage in the gym all the time but a new study suggests when it comes to training your arms changing from a standing to a lying position makes no difference.

21 males performed overhead dumbbell extensions and lying dumbbell extensions. Researchers measured muscle activity in the triceps during each exercise. Their findings: Concentric and eccentric muscle activity patterns were essentially the same during each exercise. Even when the concentric contraction was divided into the initial, middle and final parts muscle activity was the same. This means changing from a standing to a lying position made no difference to the level of stimulus on the three triceps heads.

This result is not unique. An almost identical study compared biceps brachii activity during a standing dumbbell curl, incline dumbbell curl and dumbbell preacher curl. Below are the results.



As can be seen there was no significant difference in biceps activity between the standing and incline dumbbell curl. Muscle activity during the preacher curl demonstrated the opposite trend with maximum activity occurring during the initial phase and decreasing as the biceps shortened. This suggests the position of the upper arm influences biceps activity (it was hanging straight during the standing and incline curl but at a 50° angle to the body during the preacher curl). Combining a dumbbell curl with a preacher curl is therefore more effective compared with performing standing and incline dumbbell curls in the same workout.

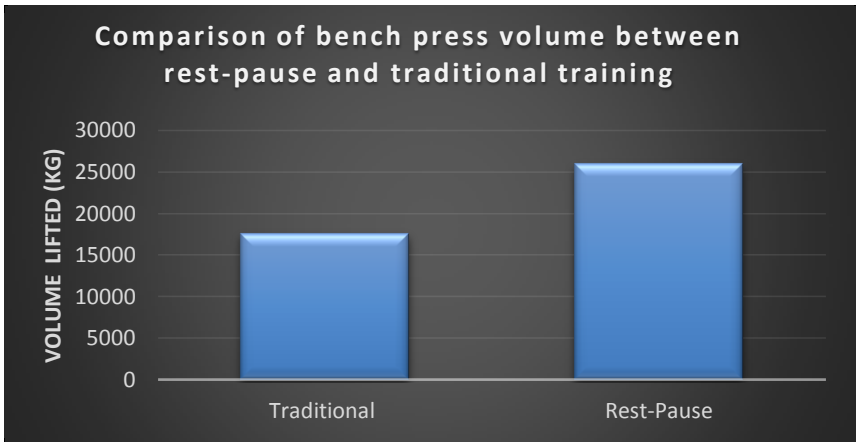
Changing the position of your body for an exercise is no guarantee you will change the stress on the muscles. To avoid wasting your time it would be more beneficial to perform a completely different exercise or switch to a barbell or machine.

Pause a moment to think about this one

The traditional way of approaching a set for a given exercise is to perform your repetitions one after the other. We do this for two reasons; firstly, it's just instinct. Secondly, the underlying premise most athletes subscribe to is to induce maximum fatigue in the working muscle. This is best achieved by performing repetitions continuously until no more can be completed. Traditions however sometimes need to change to keep up with the times.

An alternative training approach is to incorporate a brief pause after each repetition. Known as rest-pause training, it involves performing a repetition, placing the weight back on the ground or rack and resting a few seconds before performing another repetition. This process is repeated until either momentary muscular failure or the desired number of repetitions is reached. Using this technique maximum muscle fatigue is still achieved however it is delayed compared to straight repetitions. This means more total volume can be lifted.

A recent study published in the *European Journal of Applied Physiology* put 20 males with weight training experience through 4 weeks of bench press training. Performing 2 training sessions per week, each session consisted of 4 sets of bench presses at 80% 1RM. Half the volunteers performed traditional sets while the other half performed rest-pause training. This involved a 4 second rest after each repetition where the bar was placed back on the rack. All groups trained to volitional fatigue. At the conclusion of the 4-week training period both groups had increased their 1RM equally, suggesting rest-pause training is no more effective. Check out the graph below though:

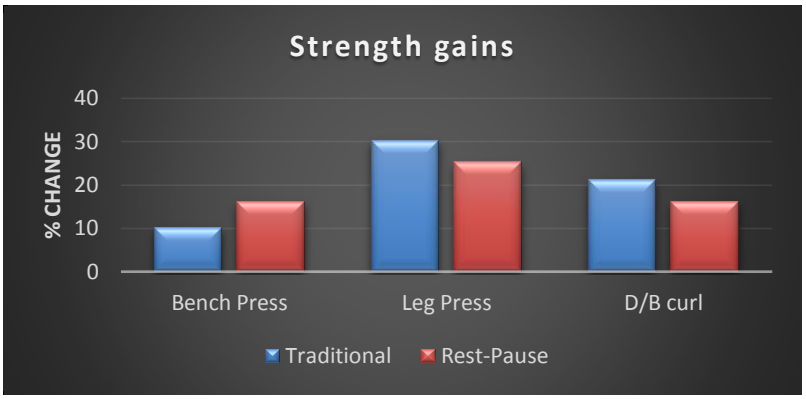


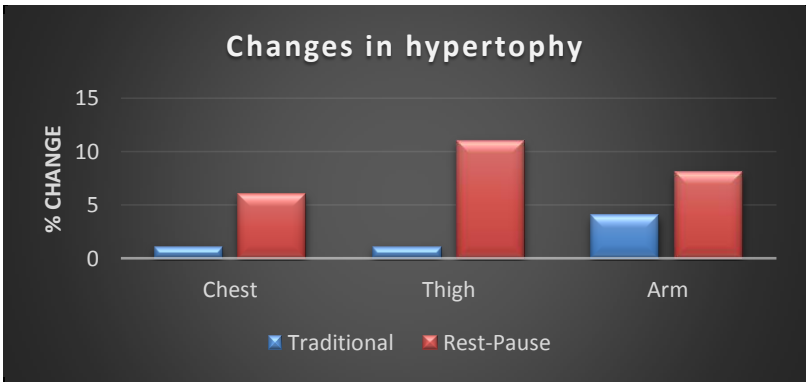
Despite the similar increases in bench press 1RM the total volume lifted over the 4-week period was 33% greater in the rest-pause group. Would this translate to better performance over a longer training period? Assuming volume lifted is the primary factor determining long-term strength and hypertrophy adaptations then rest-pause training on key exercises may be a superior method. Unfortunately, no long-term studies have looked at this question so there is no definitive answer at this stage.

As well as the lack of research examining rest-pause training another problem with the existing scientific literature is defining rest-pause training. Some studies, like this present one,

define it as a brief pause after each repetition while others have defined it as performing a traditional set to failure then resting briefly before performing individual repetitions, each followed by a brief rest until the desired number of repetitions have been achieved.

A study published earlier this year applied this latter technique to a 6-week training program using volunteers with weight training experience. Applying this type of rest-pause training to the bench press, leg press and standing dumbbell curl, all participants performed 18 repetitions for each exercise using 80% of their 1RM. Half performed 3 sets of 6 repetitions with 2-minutes rest between sets while the other half performed repetitions to failure, rested 20 seconds, then performed individual repetitions with 20 seconds rest until all 18 repetitions had been completed. Other exercises were also incorporated into the 4-day per week training program but these were performed as traditional sets. So how did this approach do?





After 6 weeks of training there was no significant differences in 1RM strength gains between the traditional and rest-pause groups. In regards to hypertrophy the only result that was statistically significant was for thigh mass which increased 11% with rest-pause training and 1% with the traditional sets (keep in mind these are group averages – there was wide inter-individual variability). Unlike the previous study this one did not record training volume.

Rest-pause training can be approached in a number of different ways and therefore presents a variety of alternatives to traditional set configurations. The lack of long-term studies on its efficacy compared with traditional sets means no recommendations can be made as to the type or duration of rest-pause training that produces optimum results. The limited research involving short-term training periods does suggest it may have potential benefit however.

Food for thought

Once your workout is over the priority switches from energy generation to repair and recovery. This means carbohydrates to replenish glycogen stores, protein for the repair and remodelling of damaged muscles, water to restore hydration and vitamins and minerals to support the elevated rate of biochemical reactions occurring. You could meet your nutritional needs with a meal of lean meat, a baked potato or two and a large serving of vegetables, but chances are your choice of nutrition comes in the form of a supplement, something containing protein and fast-acting carbohydrates. This is the perfect choice for your first post-workout meal, right?

We tend to envision our food being digested into its constituent macronutrients, each of which then goes to perform its own unique function; carbohydrates are directed towards energy production and glycogen storage, protein is directed towards repair and growth of body tissues and fat is directed towards energy production and storage. This over-simplified view fails to take into account the effect macronutrient interactions have on metabolic processes.

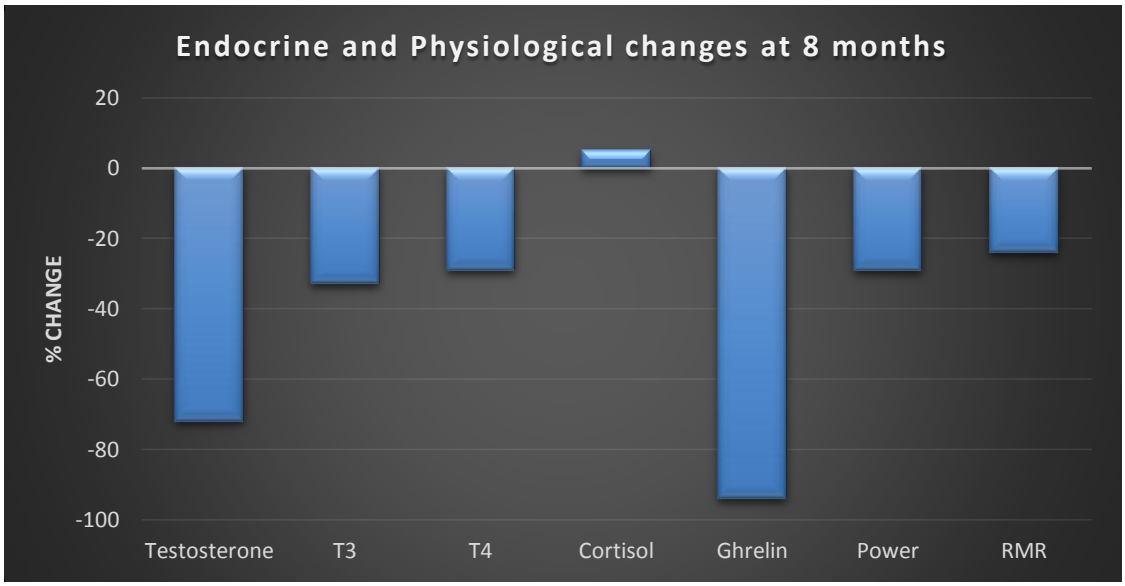
13 male and 14 female volunteers participated in a study that looked at the effect protein and sugar on energy metabolism and fat oxidation. The study was conducted over two 24 hour periods that were separated by 1 week. During the 24 hours the volunteers remained in a room calorimeter. This is a sealed room that allows researchers to accurately measure energy expenditure. On each occasion the volunteers consumed breakfast and lunch, each meal containing 500 calories. For one meal they consumed a sugar sweetened beverage (an additional 120 Calories) and the other a non-sweetened beverage. On the first occasion the meals consisted of 55% carbohydrates, 30% fat and 15% protein. On the second occasion it was 40% carbohydrates, 30% fat and 30% protein.

The addition of the high sugar drink had some interesting effects. Firstly, the additional 120 calories resulted in and extra 80 calories of energy being expended. If you do the math this means the body retained 40 more calories compared to when the non-sweetened beverage was consumed. The sugar drink also reduced fat oxidation by an average 8% compared with the non-sweetened drink. Protein intake significantly influenced fat oxidation. The sugar sweetened drink decreased fat oxidation by an average 7.2 g/day with the 15% protein meal and an average 12.6 g/day with the 30% protein meal.

The results of this study demonstrate how consuming a sugar-sweetened drink with a high-protein meal alters metabolism in favour of fat storage. A caveat to these results is that the individuals were not active (other than moving around the room). Despite this limitation this study is still relevant because many supplements, in particular the ones designed as ‘mass builders’ contain high levels of high glycaemic carbohydrates. If you consume such a supplement 2 or 3 times during the day could it be altering your metabolism in favour of fat storage? It is a legitimate question worth asking.

More evidence of the dangers of bodybuilding contest preparation

Last month we discussed a case study showing the detrimental physiological and endocrine effects of bodybuilding contest preparation. Another case study has recently been published that focussed on the hormone and metabolic changes of a bodybuilder during 8 months of contest preparation and 5 months of recovery. Below are the results after 8 months.



As can be seen from the above graph the effects of contest preparation on endocrine and physiological function were profound. Testosterone decreased by 72%, thyroid hormones T3 and T4 decreased 33% and 29% respectively, cortisol increased 5%, ghrelin (often described as the hunger hormone because it increases our motivation to eat) decreased 94%, anaerobic power decreased 29% and resting metabolic rate decreased 24%. Energy intake during this period dropped from 3860 Calories per day to 1724. 5 months after cessation of the pre-contest preparation all the above measures returned to near baseline levels taken before the start of the pre-contest preparation.

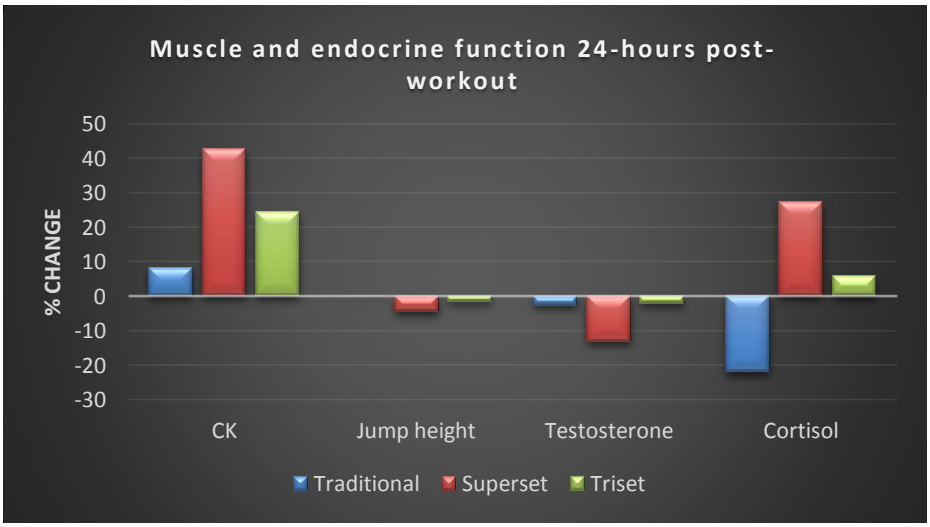
The lesson to take from this is that in trying to get the 'ripped' look of high muscularity with minimum body fat does have consequences. The American Council on Exercise recommends as a general rule a healthy body fat percentage for male athletes is 6-13% and 14-20% for female athletes. Bodybuilders do take diet and exercise to the extreme but this is generally for a short period of time during the year. The endocrine disturbances for the individual in this study were reversed without long-term effects but if you were to continue this style of eating and working out for a protracted period you could very well end up with some long-term impairments.

Greater efficiency means grater recovery time

If you are short on time one technique you could employ during your workout is super-sets and tri-sets. This is where you alternate between different exercises so that when one muscle group is resting another is still working. A classic example is to alternate pushing and pulling exercises such as dips and pull-ups. Not only does this style of training maximise the amount of work you do in a short period of time but it also greatly increases the intensity of your workout. The downside to performing supersets and tri-sets is that the increased intensity may require a greater period for recovery.

14 male rugby union players with weight training experience were put through 3 workouts consisting of 3 sets of 10 repetitions of squats, bench press, Romanian deadlift, dumbbell shoulder press, bent-over row and upright row. Intensity was 65% of the 3RM for each exercise. The first workout consisted of traditional sets with 2 minutes rest between each set. The second workout consisted of supersets (squat/bench press, Romanian deadlift/shoulder press, bent-over row/upright row) with 2-minutes rest between supersets, and the third workout consisted of tri-sets (Squat/bench press/Romanian deadlift, shoulder press/bent-over row/upright row), again with 2-minutes rest after each tri-set.

Not surprisingly the tri-set configuration resulted in the shortest workout time (18 min), followed by the superset (24 min) and the traditional sets (42 min). Muscle damage and hormone profile told an interesting story:



24-hours post-workout muscle recovery had almost returned to pre-training levels with the traditional sets. The superset protocol produced the greatest level of muscle damage, evidenced by the greatest increase in creatine kinase (CK) and decrease in vertical jump height (which is used to measure lower body muscle power). It also produced the greatest decrease in testosterone and increase in cortisol 24-hours post-workout. This indicates that a single bout of super-set training produces a greater physiological stress that requires more recovery time.

Muscle recovery is not as straight forward as you think

Continuing with the theme of muscle recovery it is generally thought of in binary terms; either your body has recovered from the previous workout or it has not. A new study has complicated this seemingly simple picture by suggesting some aspects of muscle function recover faster than others and this has potential implications for your plans in the gym.

For the study 26 males with weight training experience performed 8 sets of bench presses to failure using 90% of their 10RM with 2-minutes rest between sets. At 24, 48, 72 and 96-hours post-workout bench press power (2 sets of 4 repetitions) and endurance (1 set of 20 repetitions) were measured. It was found power returned close to baseline levels by 72 hours but endurance was still around 8% below baseline levels by 96-hours. Participants subjective feelings of full recovery had occurred by 72-hours. This indicates that a muscles ability to generate power may recover faster than its ability to perform high volumes of work.

References

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Pause a moment to think about this one

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Food for thought

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