

## Using Push-Pull-Legs Training : A Weight Training Method for Muscle Hypertrophy in Upper Body on Amateur Athletes

<sup>1</sup>Vlad Adrian Geantă

<sup>1</sup>PhD Student at University of Pitești, Faculty of Science, Physical Education and Informatics, Romania

**Correspondence:** Vlad Adrian Geantă (vladu.geanta@gmail.com)

### Abstract

**Introduction:** Over time the information in the science of sports training is updated fantastically quickly. In weight training, in addition to classic training methods, the popularization of new training methods is sought, which come in support of the performer athlete or the individual who practices in the form of agreement, in achieving the stability objectives. **The aim** of this paper represent the hypertrophic effects that push-pull (PP) training can have on the upper body of amateur lifters. **Methods:** The study lasted for 6 weeks in a fitness center and the subjects ( $N = 6$ ,  $M_{(y)}$   $23 \pm 1.1y$ ,  $M_{(h)}$   $179.8 \pm 2.9$  cm,  $M_{(w)}$   $74.3 \pm 2.9$  kg,  $BMI_{(i)}$   $23.4 \pm 0.9$  kg/m<sup>2</sup>) were selected as participants. The routine consisted of 3 workouts/week. The participants trained using the method (PPL) but with the observation that the study followed the hypertrophic effects achieved on the upper body following the push-pull (PP) training. Measurements of the circumference of the pectoral (Ch), flexed arm (Ar) and the width of the shoulders (Sh), were measured using a metric band in two stages, an initial stage ( $Ch_{(i)}$   $102 \pm 1.8$ ,  $Ar_{(i)}$   $37.8 \pm 0.8$ ,  $Sh_{(i)}$   $46.7 \pm 2.7$ , and a final, to see if it exists there is -500, and for height a tachometer. For evaluating body mass  $W_{(i)}$ ,  $W_{(f)}$  and body mass index  $BMI_{(i)}$   $BMI_{(f)}$ , we used an Omron HGF-500 scale, and a stadiometer for height. **Results:** After the 6 weeks of training, the expected hypertrophic results were recorded ( $BMI_{(f)}$   $22.2 \pm 0.7$ ,  $W_{(f)}$   $74.7 \pm 1.5$ ,  $Ch_{(f)}$   $102.9 \pm 1.7$ ,  $Ar_{(f)}$   $38.4 \pm 0.6$ ,  $Sh_{(f)}$   $47.4 \pm 2.5$ ). Alternatively, we used the T test ( $T = 2.01$  for  $p < 0.05$ ) to tell us if there were any significant changes. We can say that the PP method is effective at the level of the upper train. **Conclusions:** Within the limits of the study, it can be concluded that significant changes can occur using the PP training method.

**Keywords:** physical activity, assessment, fitness, hypertrophy, training, athletes, bodybuilding

## **Introduction**

Weight training is a way to improve or maintain fitness through rigorous exercise according to a schedule, depending on the needs of the individual. The interest in developing and maintaining fitness through weight training among the population of all ages is growing, but a special concern is addressed among young people (Eston and Reilly, 2009, p. 75). A workout that directly causes muscle hypertrophy is essential to be planned carefully to avoid the plateau effect. Every young person today who walks into a gym aims to either lose extra pounds, or want a hypertrophic effect as soon as possible. Muscle hypertrophy is a point of interest for leisure athletes who practice leisure, who aspires to develop their physique to the fullest. (Schoenfeld, 2010). Exercise or regular physical activity is a solid stimulus for adaptation (Zatsiorsky, Kraemer and Fry, 2020, p. 4). The stimulus in this study is PP training. In studies conducted on human subjects, factors such as temperature and humidity in the laboratory and the amount of light and noise in the test area can significantly affect physiological responses, both at rest and during exercise (Kenney, Wilmore and Costill 2020, p. 22). Scientists interested in exercise and sports science are actively engaged in research to better understand the mechanism that regulates the body's physiological response to acute exercise crises and its adaptations to training and coaching (Kenney, Wilmore and Costill 2020, p. 17). Today, gyms have become a successful business due to the growing number of subscribers. In the recreational or sedentary individual, health and fitness assessment assesses healing (Hoffman 2006, p. 3). The main objective of weight training is to improve the physical condition of the athlete through body shaping, and where appropriate and the level of performance. The development of a training model begins with the research on specialized scientific literature on sports topics, for the subsequent finding of the best solutions. In sports, general physical development is a necessity (Bompa and Haff, 2014, p. 31) because it helps to shape the future of the athlete, whether we are talking about performance or leisure. Over time,

the athlete develops and the training must be individualized, being mainly focused on the skills that the athlete has. In weight training, in addition to gaining strength, there is also gaining muscle mass. Strength exercises involve polyarticular exercises, which use large muscle groups (Hoffman 2006, p. 27). In weight training, if we either want to improve muscle mass or remove adipose tissue and build muscle, this can only be done through a specific training program (Geanta & Herlo, 2020). The multijoint or basic exercises in the popular term, evaluate both the force of the upper body and the lower body of the human body. If the goals of the training program are to maximize hypertrophy, we will need to constantly change the training stimulus (Hoffman, 2002, p. 72). In this study, we will address practical aspects of the push-pull training method. This type of training comes from the bodybuilding world (Paige, 2020) it is usefulness being in maximizing training as well as the recovery period of the athlete, essential variables in stimulating hypertrophy. Push-pull-legs (PPL) training is a method whose routine is divided into different muscle groups and workouts (Castanheira et al. 2017). The Push-Pull-Legs (PPL) workouts it is a routine consisting of 3 workouts per week, which is divided into a push training workout, a pull-up workout and a leg workout (Duquette, Walker-Ng, BHSc, PTS, 2020) and this study only focuses on the results of push and pull workouts. This method is great for any practitioner. sports. Through this method, practitioners will have the opportunity to perform shorter workouts than the classic ones. PPL method is great for any practitioners. Through this method, practitioners will have the opportunity to perform shorter workouts than the classic ones. Push training is required for the muscles of the pectoral, deltoids and triceps. Alternatively, pull training is designed for hypertrophy of the back and biceps muscles. Obviously, this routine consists of basic or compound exercises, but with a few exceptions, isolation exercises can be introduced that can push & pull. In this study, we start from the hypothesis that push-pull (PP) training will bring improvements in the body circumferences of the upper body to novice subjects. Also, the methods of training on the circuit (Geanta & Ardelean, 2021a) or by using well-known principles of

weight training in bodybuilding (Geantă & Ardelean 2021b), have had positive results among the subjects subjected to research. In the classic muscle growth technique, we stimulate one or two muscle groups every day (Armstrong, 2020). Trinh (2019) believes that the classic training method requires more time spent in the gym and has an increased risk of overtraining compared to the push-pull training method. This type of training has gained popularity among bodybuilders and those who practice this sport as a leisure activity, due to the optimization of recovery time between workouts, supporting hypertrophy and fat burning (van de Walle, 2020; Bedosky, 2021). Thus, adding push-pull exercises to our training routine can provide a balance to our body (Perez, 2020). Beginners who have less than 6 months of practice should alternate training days with recovery days performing a maximum of 3 training sessions per week for effective recovery, thus avoiding injury or overtraining (Guide to Push-Pull Workouts, 2020). Skeletal muscle is dynamic in its response to training and can adapt to various functional requirements (Hoffman 2002, p. 12). When the skeletal muscle is subjected to a stimulus of up to 60-70% of its maximum working capacity, adaptations occur, which can lead to muscle hypertrophy (MacDougall 1922, quoted by Hoffman 2002, p.12). Applying basic knowledge allows trainers to perform better and more safely (Howley & Thompson, 2012, p. 52), so very participants must be as well trained as possible.

## **Methods**

### *Subjects and experimental design*

A sample of male subjects ( $N = 6$ ,  $M(y)$ 23±1.1y,  $M(h)$ 179.8±2.9cm,  $M(w)$ 74.3±2.9kg,  $BMI(i)$  23.4±0.9kg/m<sup>2</sup> ), clients of a gym in Arad, were selected to participate in this study. Subjects accepted in the study were required to be at least 18 years old and not have health problems (Gentil, Soares & Bottaro 2015). All participants were fully motivated and curious about this training method.

### *Materials and methods*

The aim of the study is whether using the (PP) method, the subjects will improve their body circumference at the level of the upper train through a hypertrophic response. Subjects were measured in two stages: an initial measurement and a final measurement. In terms of physical characteristics, subjects were initially measured in terms of shoulder width  $Sh(\cdot)46.7\pm 2.7$ , pectoral circumference  $Ch(\cdot)102\pm 1.8$ , and arm in the flexed position  $Ar(\cdot)37.8\pm 0.8$ . For the measurements, we used a stadiometer for height, a metric band for measuring the circumferences (pectorals, flexed arm) as well as the width of the shoulders, and an Omron-HGF500 scale for measuring body mass and BMI. Measurement is the act of assessment (Morrow, Mood, Disch & Kang 2016, p. 5). The anthropometric measurements used by researchers depend on the purpose of the evaluation (Reiman & Manske, 2009, p. 31). Measurements performed at the beginning and end of an experiment can provide valuable information on the subjects' response to training (McGuigan, 2017, p. 4-5). The technique of measuring body perimeters involves placing a flexible measuring tape made of cloth over an area of the body and measuring its circumference (Schoenfeld, 2021, p. 69-70). According to Atherton, Phillips and Wilkinson (2015), the assessment of subjects by measuring body circumference is better compared to skin fold testing. Although the terms body mass and weight are used interchangeably, it is more accurate to use the term body mass (Haff & Dumke 2018, p. 3). Statistical analysis was performed using SPSS (v.20.0). We calculated the mean, standard deviation, and t-test dependent, for  $p \leq 0.05$ .

### *Training program*

The study lasted for 6 weeks with a frequency of 3 workouts/week and with varying intensities. In order not to confuse, the subjects also performed leg training, a component of the push-pull-legs (PPL) method, but the research interest was directed toward the results generated only by the push-pull (PP) workouts. For 6 weeks, the workouts were grouped into a push workout, a leg workout and

a pull workout. Each week varied both in terms of intensity and in terms of the number of sets and repetitions so that the hypertrophic response of the subjects to these workouts was positive. Each exercise was explained and demonstrated to the participants in the most accurate way possible. Trainings have been designed to be in line with the strengths of the individual in terms of their strength and endurance. Compound exercises were mostly used to test for a positive hypertrophic response. The example of a training program for 1 week can be seen in Table no. 1.

## **Results**

At the end of the experiment, all the parameters obtained were statistically processed and compared with the values recorded in the initial measurements. From the group of participants, there were subjects who responded very well to the training, having a good evolution, but also subjects who registered slower progress due to various causes. Obviously, the interest of the study was not only aimed at the hypertrophic response of the subjects to training but also indirectly at improving their well-being through regular exercise. In table no. 2 we can observe the physical characteristics of the participants in both the initial and final measurement, reported by Mean (M) and Standard Deviation (SD).

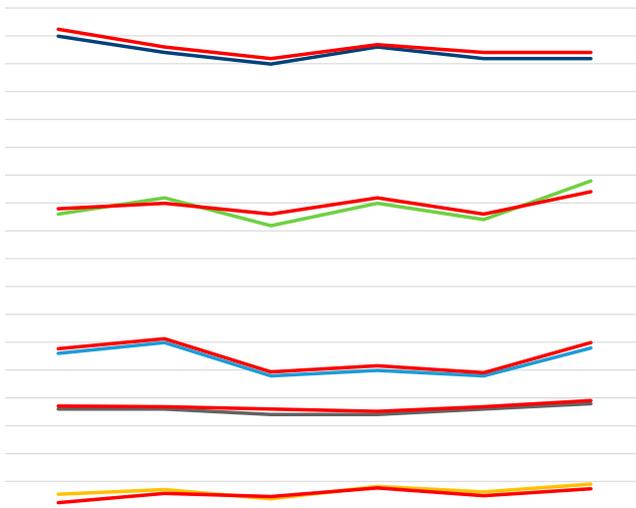
It can be seen that the homogeneity of the group is acceptable, although they voluntarily participated in this study. Alternatively, we used the T-dependent test to determine whether the results are significant by the working method (PP), obtaining the following values ( $T = 2.01$ ). In figure no. 1, we will be able to observe much more clearly the evolution of the study participants, from the initial testing to the final one represented by the red line.

Table 1. A routine of one week of the PPL training.

Approx. Load (% 1RM)	65%		70%		65%		70%		75%	
	<b>Workout nr. 1 - Push</b>		<b>Monday</b>		<b>Monday</b>		<b>Monday</b>		<b>Monday</b>	
Barbell Bench Press	3 x 12	4 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
Military Shoulder Press	3 x 12	4 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
Triceps extension with Z-bar	3 x 12	4 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
Weighted crunches	3 x 12	4 x 15	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
	<b>Workout nr. 2 - Lower Body</b>		<b>Wednesday</b>		<b>Wednesday</b>		<b>Wednesday</b>		<b>Wednesday</b>	
Squats	3 x 10	4 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
Deadlifts	3 x 10	4 x 8-10	4 x 8	3 x 8	4 x 8	3 x 8	4 x 8	3 x 8	4 x 8	4 x 8
Leg Curls	3 x 10	4 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
Standing Barbell Calf Raise	3 x 10	4 x 20	4 x 10	3 x 15	4 x 10	3 x 15	4 x 10	3 x 15	4 x 10	4 x 8
	<b>Workout nr. 3 - Pull</b>		<b>Friday</b>		<b>Friday</b>		<b>Friday</b>		<b>Friday</b>	
Lat pulldowns	3 x 12	4 x 10	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
T-Bar Rows	3 x 12	4 x 10	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
Upright Rows	3 x 12	4 x 10	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8
Biceps Z-bar curls	3 x 12	4 x 10	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	3 x 12	4 x 10	4 x 8

**Table 2. Data presented with Mean and SD.**

<b>Variable</b>	<b>Initial</b>	<b>Final</b>
<b>Age (y)</b>	<b>23 ± 1.1</b>	-
<b>Height (cm)</b>	<b>179.8 ± 2.9</b>	-
<b>Weight (kg)</b>	<b>74.3 ± 2.9</b>	<b>74.7 ± 1.5</b>
<b>BMI (kg/m<sup>2</sup>)</b>	<b>23.4 ± 0.9</b>	<b>22.2 ± 0.7</b>
<b>Shoulders width (cm)</b>	<b>46.7 ± 2.7</b>	<b>47.4 ± 2.5</b>
<b>Chest (cm)</b>	<b>102 ± 1.8</b>	<b>102.9 ± 1.7</b>
<b>Arm flexed (cm)</b>	<b>37.8 ± 0.8</b>	<b>38.4 ± 0.6</b>



**Fig. 1.** Physical characteristics of the participants at the initial and the final measurements.

## **Discussions**

As Schoenfeld (2019) tells us, muscle hypertrophy occurs when skeletal muscles receive a stimulus that causes disturbances in myofibers and the associated extracellular matrix. After 6 weeks of intense training, the results are meritorious. The most interesting thing could be a proposal to compare the PP method, with the classic bodybuilding training method, for beginners, noting which method is more effective. The results can tell us that the subjects had a natural growth. They were informed that they must have proper nutrition and recovery for their efforts to be worthwhile. Because there are both good and bad developments, certainly not all subjects strictly followed the instructions given at the beginning of the experiment. Obviously, over time to avoid the plateau effect, subjects who decide to make a lifestyle out of this sport will have to constantly change the way they train, to avoid the plateau effect. From the first week of training, we could see an increase in well-being among the participants and from here we can say that the sport practiced as a means of leisure, relaxes, improving well-being.

## **Conclusions**

Given the importance of training periodization to get results, see that the purpose of the work has been successfully achieved. The push-pull training method (PP) was successful among amateur athletes, with a positive hypertrophic response on the upper body. One of the limited studies was that I only had 6 weeks to try the next one. The application of the program was successful, although there were participants with good evolutions and participants with less good evolutions. Alternatively, it may be possible for subjects to be evaluated in a laboratory with equipment to obtain a much greater evidence at the muscular level of the hypertrophic response, which was another limitation of the study. Because the positive results appeared, the subjects will be much more motivated in the future

to continue practicing these physical exercises, but with more pleasure. However, this study indirectly encourages young people to exercise through exercise, no matter what level they are performed.

## References

1. Atherton, P. J., Phillips, B. E., & Wilkinson, D. J. (2015). *Exercise and Regulation of Protein Metabolism. Progress in molecular biology and translational science, 135*, 75–98. <https://doi.org/10.1016/bs.pmbts.2015.06.015>
2. Armstrong, G. G. B. (2020). *How to Maximize Your Workout with Push-Pull Strength Training*. Scientific American. Retrieved December 3, 2021, from <https://www.scientificamerican.com/article/how-to-maximize-your-workout-with-push-pull-strength-training/>
3. Bedosky, L., (2021). *The Push-Pull Workout*. Experience Life. Retrieved December 4, 2021, from <https://experiencelife.lifetime.life/article/the-push-pull-workout/>
4. Bompa, T. & Haff, G. (2009). *Periodization: Theory and methodology of training*. Champaign IL: Human Kinetics.
5. Castanheira, R., Ferreira-Junior, J. B., Celes, R. S., Rocha-Junior, V. A., Cadore, E. L., Izquierdo, M., & Bottaro, M. (2017). *Effects of Synergist vs. NonSynergist Split Resistance Training Routines on Acute Neuromuscular Performance in Resistance-Trained Men. Journal of strength and conditioning research, 31*(12), 3482–3488. <https://doi.org/10.1519/JSC.0000000000001762>
6. Duquette, S., Walker-Ng, M., BHSc, PTS (2020). *Are 3-Day Push/Pull/Legs Split Routines Good for Building Muscle?* Outlift. Retrieved December 3, 2021, from <https://outlift.com/push-pull-legs>
7. Eston, R. G., & Reilly, T. (2009). *Kinanthropometry and exercise physiology laboratory manual: Tests, procedures and data*. Abingdon, Oxon: Routledge.

8. Geanta, V. A., & Herlo, J. N. (2020). *Comparative Study on Multi-Joint and Single-Joint Exercises in Bodybuilding Economics*. *Arena-Journal of Physical Activities*, (9), 81-92.
9. Geanta, V. A., & Ardelean, V. P. (2021a). *Effects of circuit training at home: Improving well-being and quality of life in sedentary men during the Covid-19 pandemic*. In: D. Rad, T. Dughi, R. Maier, A. Egerău (Ed.), *Applied Research in Digital Well-being* (81-93), ISBN: 978-3-631-87105-8. Berlin: Peter Lang Publishing House, DOI: [10.3726/b19309](https://doi.org/10.3726/b19309)
10. Geantă, V. A., & Ardelean, V. P. (2021b). *Improving muscle size with Weider's principle of progressive overload in non-performance athletes*. *Timisoara Physical Education and Rehabilitation Journal*, 14(27) 27-32. <https://doi.org/10.2478/tperj-2021-0011>
11. Gentil, P., & Bottaro, M. (2013). *Effects of training attendance on muscle strength of young men after 11 weeks of resistance training*. *Asian journal of sports medicine*, 4(2), 101–106. <https://doi.org/10.5812/asjasm.34489>
12. Gentil, P., Soares, S., & Bottaro, M. (2015). *Single vs. Multi-Joint Resistance Exercises: Effects on Muscle Strength and Hypertrophy*. *Asian journal of sports medicine*, 6(2), e24057. <https://doi.org/10.5812/asjasm.24057>
13. *Guide to Push-Pull Workouts*. (2020). *Training & Conditioning*. Retrieved December 3, 2021, from <https://training-conditioning.com/news/guide-to-push-pull-workouts/>
14. Haff, G., & Dumke, C. (2018). *Laboratory manual for exercise physiology*. Champaign, IL: Human Kinetics.
15. Hoffman, J. (2002). *Physiological aspects of sport training and performance*. Champaign, Ill: Human Kinetics.
16. Hoffman, J. (2006). *Norms for fitness, performance, and health*. Champaign, IL: Human Kinetics. pag.
17. Howley, E. T., & Thompson, D. L. (2012). *Fitness professional's handbook*. 6th ed. Champaign, IL: Human Kinetics.
18. Kenney, W. L., Wilmore, J. H., & Costill, D. L. (2020). *Physiol-*

- ogy of sport and exercise. Champaign, IL: Human Kinetics.
19. McGuigan, M. (2017). *Monitoring training and performance in athletes*. Champaign, IL: Human Kinetics
  20. Morrow, J. R., Mood, D., Disch, J. G., & Kang, M. (2016). *Measurement and evaluation in human performance*. Champaign, IL: Human Kinetics.
  21. Paige, W. (2020). *Try Push-Pull Strength Training to Burn Calories and Build Muscle*. Retrieved December 4, 2021, from <https://www.verywellfit.com/push-pull-strength-training-routine-1231091>
  22. Perez, E. (2020). *The Push and Pull Workout Plan*. Studio SWEAT OnDemand. Retrieved December 3, 2021, from <https://www.studiosweatondemand.com/ssod-articles/schedule-best-simple-push-pull-workout-routine-plan/>
  23. Reiman, M. P., & Manske, R. C. (2009). *Functional testing in human performance*. Champaign, IL: Human Kinetics.
  24. Schoenfeld B. J. (2010). The mechanisms of muscle hypertrophy and their application to resistance training. *Journal of strength and conditioning research*, 24(10), 2857–2872. <https://doi.org/10.1519/JSC.0b013e3181e840f3>
  25. Schoenfeld, B. (2021). *Science and Development of Muscle Hypertrophy*. 2nd ed. Champaign, IL: Human Kinetics.
  26. Trinh, E. (2019). *Push-Pull Training 101: Everything You Need to Know*. Aaptiv. Retrieved December 3, 2021, from <https://aaptiv.com/magazine/push-pull-training>
  27. van de Walle, M. G. S. (2020). *Push-Pull Workouts: Routines and Guide for Building Muscle*. Healthline. Retrieved December 3, 2021, from <https://www.healthline.com/nutrition/push-pull-workout>
  28. Zatsiorsky, V. M., Kraemer, W. J., & Fry, A. C. (2020). *Science and practice of strength training*. Human Kinetics.