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Auswirkungen eines Maximalkrafttrainings auf die Wurfweite bei Würfeln mit unterschiedlichen Lasten

Literatur

- Aagaard, P., Simonsen, E. B., Andersen, J. L., Magnusson, P. & Dyhre-Poulsen, P. (2002). Neuronal adaptations to resistance training: Changes in V-wave and H-reflex responses. *Journal of Applied Physiology*, 92, 2309-2318.
- Aagaard, P., Simonsen, E. B., Trolle, M., Bangsbo, J. & Klausen, K. (1996). Specificity of training velocity and training load on gains in isokinetic knee joint strength. *Acta Physiologica Scandinavica*, 156, 123-129.
- Aagaard, P., Trolle, M., Simonsen, E. B., Klausen, K. & Bangsbo, J. (1993). High speed knee extension capacity of soccer players after different kinds of strength training. In T. Reilly, J. Clarys & A. Stibbe (Eds.), *Science and Football II* (pp. 92-94). London/New York: E. & F. N. Spon.
- Ahtiainen, J. P., Pakarinen, A., Alan, M. A., Kraemer, W. J. & Häkkinen, K. (2003). Muscle hypertrophy, hormonal adaptations and strength development during strength training in strength-trained and untrained men. *European Journal of Applied Physiology*, 89, 555-563.
- Akima, H., Kuno, S., Takahashi, H., Fukunaga, T. & Katsuta, S. (2000). The use of magnetic resonance images to investigate the influence of recruitment on the relationship between torque and cross-sectional area in human muscle. *European Journal of Applied Physiology* 83, 475-480.
- Allmann, H. (1985). Maximalkraft und Sprintleistung – Maximalkrafttraining im Sprinttraining. In M. Bührle (Hrsg.), *Grundlagen des Maximal- und Schnellkrafttrainings* (S. 282-300). Schorndorf: Hofmann
- Antonio, J. (2000). Nonuniform response of skeletal muscle to heavy resistance training: can bodybuilders induce regional muscle hypertrophy? *Journal of Strength and Conditioning Research*, 14 (1), 102-113.
- Baker, D., Wilson, G. & Carlyon, R. (1994). Periodization: The effect on strength of manipulating volume and intensity. *Journal of Strength and Conditioning Research*, 8 (49), 235-242.
- Behm, D. G. & Sale, D. G. (1993). Velocity specificity of resistance training. *Sport Medicine*, 15 (6), 374-388.
- Berger, R. & Henderson, J. M. A. (1966). Relationship of power to static and dynamic strength. *The Research Quarterly*, 37 (1), 9-13.
- Bompa, T. (1990). *Theory and Methodology of Training. The Key to Athletic Performance* (2nd edition). Dubuque: Kendall/Hunt.
- Bös, K., Hänsel, F. & Schott, N. (2000). *Empirische Untersuchungen in der Sportwissenschaft. Planung – Auswertung – Statistik*. Hamburg: Czwalina.
- Büdingen, H. J. & Freund, H.-J. (1976). The relationship between the rate of rise of isometric tension and motor unit recruitment in a human forearm muscle. *Pflügers Archive*, 362 (1), 61-67.
- Buford, T. W., Rossi, S. J., Smith, D. B. & Warren, A. J. (2007). A comparison of periodization models during nine weeks with equated volume and intensity for strength. *Journal of Strength and Conditioning Research*, 21 (4), 1245-1250.
- Bührle, M. (1993). Schnellkraft. *Spectrum der Sportwissenschaften*, 5 (2), 5-29.
- Bührle, M. & Schmidtbleicher, D. (1977). Der Einfluß von Maximalkrafttraining auf die Bewegungsschnelligkeit. *Leistungssport*, 7 (1), 3-10.
- Bührle, M. & Werner, E. (1984). Das Muskelquerschnittstraining der Bodybuilder. *Leistungssport*, 14 (3), 5-9.
- Bührle, M., Gollhofer, A., Kibele, A., Müller, K. J., Schwirtz, A., Schweizer, L. & Strass, D. (1995). Theorie und Praxis des Krafttrainings. In K. Carl, K. Quade & P. Stehle (Hrsg.), *Krafttraining in der sportwissenschaftlichen Forschung* (S. 178-216). Köln: Sport und Buch Strauß.
- Cabri, J., De Proft, E., Dufour, W. & Clarys, J. P. (1988). The relation between muscular strength and kick performance. In T. Reilly, A. Lees, K. Davids & W. J. Murphy (Eds.), *Science and Football: Proceedings of the First World Congress of Science and Football* (pp. 186-193). London: E. & F. N. Spon.
- Carlock, J. M., Smith, S. L., Harman, M. J., Morris, R. T., Ciroslan, D. A., Pierce, K. C., Newton, R. U., Harman, E. A., Sands, W. A. & Stone, M. H. (2004). The relationship between vertical jump power estimates and weightlifting ability: a field-test approach. *Journal of Strength and Conditioning Research*, 18 (3), 534-539.
- Chelly, M. S., Hermassi, S. & Shepard, R. (2010). Relationship between power and strength of the upper and lower muscles and throwing velocity in male handball players. *Journal of Strength and Conditioning Research*, 24 (6), 1480-1487.
- Chilibeck, P. D., Calder, A. W., Sale, D. G. & Webber, C. E. (1998). A comparison of strength and muscle mass increases during resistance training in young women. *European Journal of Applied Physiology*, 77, 170-175.
- Deiss, D. & Pfeiffer, U. (1991). *Leistungsreserven im Schnellkrafttraining*. Berlin: Sportverlag.
- Dengel, D. R., George, T. W., Bainbridge, C., Fleck, S. J., van Handel, P. J. & Kearney, J. T. (1987). Training responses in national team boxers. *Medicine and Science in Sports and Exercise*, 19 (3), 47.
- De Proft, E., Cabri, J., Dufour, W. & Clarys, J. P. (1988). Strength training and kick performance in soccer players. In T. Reilly, A. Lees, K. Davids & W. J. Murphy (Eds.), *Science and Football: Proceedings of the First World Congress of Science and Football* (pp. 108-113). London: E. & F. N. Spon.
- Duchateau, J., Hainaut, K. (2003) Mechanisms of muscle and motor unit adaptations to explosive training. In P.V. Komi (Ed.), *Strength and Power in Sport* (2nd edition) (pp. 315-330). Malden (USA): Blackwell Science.
- Duchateau, J., Semmler, J. G. & Enoka, R. M. (2006). Training adaptations in the behavior of human motor units. *Journal of Applied Physiology*, 101, 1766-1776.
- Dutta, P. & Subramaniam, S. (2002). Effects of six weeks of isokinetic strength training combined with skill training on football kicking performance. In W. Spinks, T. Reilly & A. Murphy (Eds.), *Science and Football IV* (pp. 333-340). London: Routledge.
- Ehrlenz, H., Grosser, M. & Zimmermann, E. (2003). *Krafttraining. Grundlagen, Methoden, Übungen, Leistungssteuerung, Trainingsprogramme*. München: bfv.
- Enoka, R. M. (1997). Neural adaptations with chronic physical activity. *Journal of Biomechanics*, 30 (5), 447-455.
- Felici, F., Rosponi, A., Sbriccoli, P., Filligoi, G. C., Fattorini, L. & Marchetti, M. (2001). Linear and non-linear analysis of surface electromyograms in weightlifters. *European Journal of Physiology*, 84, 337-342.
- Gorostiaga, E. M., Izquierdo, M., Iralde, P., Ruasta, M. & Ibanez, J. (1999). Effect of heavy resistance training on maximal and explosive force production, endurance and serum hormones in adolescent handball players. *European Journal of Applied Physiology*, 80, 485-493.
- Häkkinen, K., Komi, P. V., Alén, M. & Kauhanen, H. (1987). EMG, muscle fibre and force production characteristics during a 1 year training period in elite weight-lifters. *European Journal of Applied Physiology*, 56, 419-427.
- Heyden, G., Droste, J. & Steinhöfer, D. (1988). Zum Zusammenhang von Maximalkraft, Schnellkraft und Bewegungsschnelligkeit. *Leistungssport*, 18 (2), 39-46.
- Hoff, J. & Almasbakk, B. (1995). The effect of maximum strength training on throwing velocity and muscle strength in female team-handball players. *Journal of Strength and Conditioning Research*, 9 (4), 255-258.
- Jonath, U., Haag, E., Krempel, R. & Müller, H. (1995). *Leichtathletik, Werfen und Mehrkampf*. Reinbek: Rowohlt.
- Jones, D. A., Rutherford, O. M. & Parker, D. F. (1989). Review: Physiological changes in skeletal muscle as a result of strength training. *Journal of Experimental Physiology*, 74, 233-256.
- Kibele, A. (1998). Maximalkraftzuwachs ohne Leistungsgewinn? *Leistungssport*, 28 (3), 45-49.
- Kibele, A., Müller, K. J., Bührle, M. (1989). Bilaterale Defizite bei willkürlichen Maximalkontraktionen. *Deutsche Zeitschrift für Sportmedizin*, 40 (4), 120-134.
- Kotzamanidis, C., Chatzopoulos, D., Michailidis, C., Papaikakou, G. & Patikas, D. (2005). The effect of a combined high intensity strength and speed training program on the running and jumping ability of soccer players. *Journal of Strength and Conditioning Research*, 19 (2), 369-375.
- Kraemer, W. (1997). A series of studies The physiological basis for strength training in american football: Fact over philosophy. *Journal of Strength and Conditioning Research*, 11 (3), 131-142.
- Lachowetz, T., Evon, J. & Pastiglione, J. (1998). The effects of an upper body strength program on intercollegiate baseball throwing velocity. *Journal of Strength and Conditioning Research*, 12 (2), 116-119.
- Letzelter, H. (1985). Zur Wirksamkeit der Wiederholungs- und der intensiven Intervallmethode auf Maximal- und Schnellkraftfähigkeit. In M. Bührle (Hrsg.), *Grundlagen des Maximal- und Schnellkrafttrainings* (S. 121-135). Schorndorf: Hofmann.
- Letzelter, H. & Letzelter, M. (1986). *Krafttraining. Theorie, Methoden, Praxis*. Reinbek: Rowohlt.
- McDonagh, M. J. N. & Davies, C. T. M. (1984). Adaptive response of mammalian skeletal muscle to exercise with high loads. *European Journal of Applied Physiology*, 52, 139-155.
- Menzel, H. J. (1988). *Zur Biomechanik von Schlagwurfbewegungen. Empirische Untersuchungen am Beispiel des Speerwurfes*. Frankfurt am Main: Harri Deutsch.
- Müller, E. (1982). Zur Bewegungsübertragung bei Wurfbewegungen. Eine biokinematische und elektromyographische Analyse von Wurfbewegungen. *Leistungssport*, 12 (4), 314-324.
- Müller, K.-J. (1985). Explosivkraft – eine generelle oder spezifische Eigenschaft. In M. Bührle (Hrsg.), *Grundlagen des Maximal- und Schnellkrafttrainings* (S. 144-160). Schorndorf: Hofmann.
- Müller, K.-J. (1987). Statische und dynamische Muskelkraft. Eine empirische Grundlagenuntersuchung. In H. Altenberger & E. Rümmele (Hrsg.), *Beiträge zur Sportwissenschaft. Band 7. Freiburger Dissertationsschrift*. Frankfurt am Main: Deutsch.
- Müller, K.-J. & Schmidtbleicher, D. (1987). Innervation pattern of isometric and concentric contractions of the human triceps brachii during elbow extension. In B. Jonsson, *Bio-mechanics X-A* (pp. 479-483). Champaign, IL.: Human Kinetics.
- Narici, M. V., Sirtori, M. D. & Mongoni, P. (1988). Maximal ball velocity and peak torques of hip flexor and knee extensor muscles. In T. Reilly, A. Lees, K. Davids & W. J. Murphy (Eds.), *Science and Football: Proceedings of the First World Congress of Science and Football* (pp. 429-433). London: E. & F. N. Spon.
- Newton, R. & Kraemer, W. (1994). Developing explosive muscular power: Implications for a mixed methods training strategy. *Strength and Conditioning Journal*, 16 (5), 20-31.
- Newton, R. & McEvoy K. (1994). Baseball throwing velocity: A comparison of medicine ball training and weight training. *Journal of Strength and Conditioning Research*, 8 (3), 198-203.
- O'Shea, P. (1985). Throwing Speed. Throwing, swinging, punching and hitting demand upper body power. *Sports Fitness*, (8), 66-69, 89-90.

- Reiser, M., Büsch, D. & Munzert, J. (2006). *Optimierung der inter- und intramuskulären Koordination bei maximaler Kraftentfaltung durch Imagination von Muskelkontraktionen* (S. 155-159). BISP-Jahrbuch – Forschungsförderung 2005/06.
- Rutherford, O. M. (1988). Muscular coordination and strength training implications for injury rehabilitation. *Journal of Sports Medicine*, 5, 196-202.
- Sale, D. G. (2003). Neural adaptation to strength training. In P. V. Komi (Ed.), *Strength and Power in Sport* (2nd edition) (pp. 281-314). Malden (USA): Blackwell Science.
- Schlumberger, A. (2000). *Optimierung von Trainingsstrategien im Schnellkrafttraining*. Bundesinstitut für Sportwissenschaft. Köln: Sport und Buch Strauß.
- Schmidtbleicher, D. (1985a). Diagnose des Maximal- und Schnellkraftverhaltens. In M. Bühle (Hrsg.), *Grundlagen des Maximal- und Schnellkrafttrainings* (S. 112-120). Schorn-dorf: Hofmann.
- Schmidtbleicher, D. (1985b). Klassifizierung der Trainingsmethoden im Krafttraining. *Lehre der Leichtathletik*, 1 (2), 225-230.
- Schnabel, G., Harre, D., Krug, J. & Borde, A. (2003). *Trainingswissenschaft. Leistung – Training – Wettkampf*. Berlin: Sport-Verlag.
- Semmler, J. (2002). Motor unit synchronization and neuromuscular performance. *Exercise and Sport Sciences Reviews*, 30 (1), 8-14.
- Shoep, T. C., Stelzer, J. E., Garner, D. P. & Widrick, J. J. (2003). Functional adaptability of muscle fibers to long-term resistance exercise. *Medicine and Science in Sports and Exercise*, 35 (6), 944-951.
- Staron, R. S., Malicky, E. S., Leonardi, M. J., Falkel, J. E., Hagerman, F. C. & Dudley, G. A. (1989). Muscle hypertrophy and fast fiber conversions in heavy resistance trained women. *European Journal of Applied Physiology*, 60, 71-79.
- Tidow, G. & Wiemann, K. (1993). Zur Interpretation und Veränderbarkeit von Kraft-Zeit-Kurven bei explosiv-ballistischen Kräfteinsätzen. Teil II: *Deutsche Zeitschrift für Sportmedizin*, 44 (4), 136-150.
- Trolle, M., Aagaard, P., Simonsen, J., Bangsbo, J. & Klaysen, K. (1993) Effects of strength training on kicking performance in soccer. In T. Reilly, J. Clarys & A. Stibbe (Eds.), *Science and soccer II* (pp. 95-98). London: E. & F. N. Spon.
- Van Cutsem, M., Duchateau, J. & Hainaut, K. (1998). Changes in single motor unit behaviour contribute to the increase in contraction speed after dynamic training in humans. *Journal of Physiology*, 513 (1), 295-305.
- Van den Tillar, R. & Ettema, G. (2004). A force-velocity relationship and coordination patterns in overarm throwing. *Journal of Sports Science and Medicine*, (3), 211-219.
- Voigt, M. & Klausen, K. (1990). Changes in muscle strength and speed of an unloaded movement after various training programmes. *European Journal of Applied Physiology*, 60, 370-376.
- Werschoshanskij, J. W. (1972). Grundlagen des speziellen Krafttrainings. In K. Adam & J. W. Werschoshanskij (Hrsg.), *Modernes Krafttraining im Sport* (S. 37-148). Berlin: Bartels & Wernitz KG.
- Willoughby, D. S. (1993). The effects of mesocycle-length weight training programs involving periodization and partial-equated volumes on upper and lower body strength. *Journal of Strength and Conditioning Research*, 7 (1), 2-8.
- Wilson, G. J., Murphy, A. J. & Walshe, A. (1996). The specificity of strength training: the effect of posture. *European Journal of Applied Physiology*, 73, 346-352.
- Young, W. B. (1991). The planning of resistance training for power sports. *National Strength and Conditioning Association Journal*, 13 (4), 26-29.
- Young, W. B. (1993). Training for speed/strength: heavy vs. light loads. *National Strength and Conditioning Association Journal*, 15 (5), 34-42.

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