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Personal Training Quarterly (PTQ) publishes basic educational information for Associate and Professional Members of the NSCA specifically focusing on personal trainers and training enthusiasts. As a quarterly publication, this journal's mission is to publish peer-reviewed articles that provide basic, practical information that is research-based and applicable to personal trainers.

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CONTACT

Personal Training Quarterly (PTQ)
1885 Bob Johnson Drive
Colorado Springs, CO 80906
phone: 800-815-6826
email: matthew.sandstead@nsca.com
nsca.com

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TABLE OF CONTENTS



- 04 **STRENGTH TRAINING AND ENDURANCE ATHLETES**
MARC LEWIS, MS(C), CSCS, TSAC-F
- 10 **FISH OIL SUPPLEMENTATION AND AGE-RELATED DECREMENTS IN MUSCLE MASS AND FUNCTION—A POTENTIAL ROLE FOR OMEGA-3S IN PREVENTING SARCOPENIA**
DYLAN KLEIN, PHD(C)
- 16 **TRADITIONAL VERSUS MINIMALIST FOOTWEAR—INJURY CONCERNS**
ANDY CHASSÉ, MS
- 20 **TENDINOPATHY AND A PREVENTATIVE MANAGEMENT STRATEGY FOR THE STRENGTH AND CONDITIONING PROFESSIONAL**
KEITH CHITTENDEN, MS, CSCS,*D, TSAC-F,*D
- 28 **HOW THE MEMBER EXPERIENCE IMPACTS YOUR BOTTOM LINE**
JOSH LEVE
- 30 **THE STRENGTH AND CONDITIONING PROFESSIONAL'S ROLE IN PREVENTING FALLS OF OLDER ADULTS**
JEFFREY ALEXANDER, PHD, FAACVPR
- 34 **THE IMPORTANCE OF THE INITIAL INTERVIEW—ESTABLISHING CREDIBILITY QUICKLY WITH A NEW POTENTIAL CLIENT**
ROBERT LINKUL, MS, CSCS,*D, NSCA-CPT,*D
- 36 **TRAINING CONSIDERATIONS FOR ROWING ATHLETES**
JACK CARTER AND CHAT WILLIAMS, MS, CSCS,*D, CSPS, NSCA-CPT,*D, FNSCA
- 44 **GIVING THE CLIENTS WHAT THEY WANT—A PERSONAL PERSPECTIVE**
RYAN CARVER, CSCS
- 46 **PERSONAL TRAINING FOR THE SEDENTARY OFFICE WORKER**
RYAN MCCLURE, CSCS, NSCA-CPT, AND BRYAN JACKSON, MS, CSCS, NSCA-CPT, USAW
- 54 **COMMUNICATION—INTERVIEWS FROM EXPERTS IN PERSONAL TRAINING**
CARMINE GRIECO, PHD, CSCS



STRENGTH TRAINING AND ENDURANCE ATHLETES

MARC LEWIS, MS(C), CSCS, TSAC-F

Concurrent training can be described as simultaneously training for both strength and endurance adaptations (1,18). Endurance athletes train to maximize endurance adaptations, while utilizing strength training as a supplemental method to enhance performance. The current literature suggests that strength training can be utilized to enhance endurance performance, if appropriate volume and intensity are administered (3,5,8,10,14,15). The ideal form of strength training would result in performance improvements, while minimizing muscular hypertrophy, and avoiding undesired increases in body mass and subsequent cellular alterations (i.e., decreased capillary density) (1,18). Furthermore, the ideal form of strength training would reduce the likelihood of overtraining, which has been observed when comparing concurrent training to strength or endurance training alone (18). Therefore, it can be argued that endurance athletes should attempt to identify the most efficient manner in which to strength train, without compromising their endurance training program or their performance. Considering that endurance sports generally incorporate higher training volumes, particularly within competition periods, emphasizing resistance training that facilitates increased strength and power serves an important role within the training process, and can aid in optimal recovery and efficiency of training (1,29,31). This article will examine the scientific basis for concurrent training and extend this science by emphasizing the delivery of practical recommendations for potential applications.

STRENGTH TRAINING ADAPTATIONS

There are certain hallmark adaptations associated with strength training such as increases in maximal strength (measured by one-repetition maximum [1RM]), skeletal muscle cross-sectional area (CSA), and power measures (27). These adaptations are primarily the product of neuromuscular alterations, skeletal muscle plasticity, and metabolic improvements. Neuromuscular alterations include increases in rate of force development (RFD), motor unit synchronization, frequency modulation, and autogenic inhibition, as well as a reduced antagonist inhibition (27). Skeletal muscle plasticity refers to increases in the size of individual muscle fibers, muscle fiber type transitioning, and structural alterations. Finally, metabolic improvements stimulated by chronic strength training include increases in muscle glycogen stores, as well as increases in enzymes associated with the adenosine triphosphate and phosphocreatine (ATP-PC) and glycolytic systems, respectively (27). Other adaptations include increases in bone mineral density (BMD), and increases in connective tissue stiffness (27).

ENDURANCE TRAINING ADAPTATIONS

Endurance training adaptations can be broadly described as improvements in cardiovascular, muscular, and metabolic function. Cardiovascular adaptations to endurance training include increases in maximal stroke volume (SV) and cardiac output (due to the increased SV), along with a decreased heart rate at a given submaximal intensity (4). Muscular alterations include muscle fiber transitioning, during which type II muscle fibers become

increasingly more oxidative, which ultimately alters the ratio of type IIa to IIx (4). Additionally, endurance training elicits increases in mitochondrial volume and density, which improves fat and glucose oxidation, as well as capillary density (4). Capillaries assist in oxygen delivery and clearance of metabolites, lactate, and heat, which can contribute to the milieu associated with muscular fatigue (4).

CONCURRENT TRAINING ADAPTATIONS

The concept of concurrent training interference was originally developed by Hickson, which occurs when simultaneously training for adaptations associated with strength and endurance (12). Since Dr. Hickson's initial findings, there has been a substantial amount of research examining the effects of concurrent training on strength and endurance outcomes (2,3,5,9,11,13,14,15,16,19,20,21,22,23,24,25,26,28,30,31,32,33,35,37,38,39,40,41). Currently, there is a growing body of literature supporting the theory that high-intensity strength training (e.g., loads of greater than 80% 1RM) combined with explosive, high-velocity movements can enhance endurance performance (14,15,20,21,23,24,25,32,35).

Concurrent training utilizing high-intensity strength training can improve short-term (i.e., less than 15 min) and long-term (i.e., more than 30 min) endurance performance in well-trained, highly-trained, and recreationally-trained endurance athletes; this observation has been reported in cyclists, runners, cross-country skiers, and triathletes (2,3,5,6,8,9,10,13,14,15,16,19,23,24,25,26,27,28,29,30,31,32,33,36,37). Hoff proposed that strength training improved endurance performance through an increase in maximal strength and RFD (i.e., improved neural function), as well as through increases in the percentage of type IIa muscle fibers and muscle tendon stiffness (14).

Nevertheless, there are concerns when introducing additional training stimuli into a high-volume sport (18,42). Excessive training on a short-term basis is referred to as overreaching, which is postulated to be a product of high volume, high intensity, and/or high frequency training bouts (17,18). Recovery from overreaching can be quickly achieved within a few days (18). However, chronic overreaching can lead to the development of overtraining, which can result in performance decrements (17,18). Therefore, optimal recovery and efficiency of strength training is of vital importance when supplementing an endurance training program with strength training.

ENDURANCE PERFORMANCE

There are three primary factors that account for the interindividual variance in endurance performance (maximal oxygen consumption, exercise economy, and lactate threshold); although other factors can contribute to performance in actual competition (1).

MAXIMAL OXYGEN CONSUMPTION

Maximal oxygen uptake (VO_2max) can be defined as the highest rate at which oxygen can be transported and utilized by the body during maximal exercise (4). VO_2max has long been considered one of the most important factors in determining endurance performance, and is the most commonly utilized measure to determine aerobic fitness (4). VO_2max is increased through improvements in central and peripheral mechanisms, which are primarily augmented by a periodized endurance training program

that emphasizes training with systematic variations in frequency, duration, and intensity (4,18).

There is currently no literature to suggest that strength training has a significant positive effect on the VO_2max of trained endurance athletes. However, it has been thought that improved cardiovascular function can potentially be induced through high-intensity strength training such as a decreased submaximal heart rate at a given exercise intensity.

EXERCISE ECONOMY

As defined by Saunders et al., exercise economy is the oxygen consumption required at a given absolute submaximal exercise intensity (34). It has been suggested that exercise economy has the greatest interindividual variation among well-trained endurance athletes (1,18). Costill outlined the similar VO_2max values found between well-trained endurance athletes, which led researchers to investigate other determinants of endurance performance (7). Therefore, the importance of exercise economy is emphasized when determining variability in competitions.

Hoff et al. found that heavy strength training with loads of more than 85% of 1RM elicited improvements in sport-specific exercise economy in well-trained cross-country skiers (15). In addition, Hoff and colleagues pointed out that training with an emphasis on maximal mobilization of force in the concentric action should improve exercise economy by improving neuromuscular function (15). Furthermore, Hoff et al. suggested that increases in RFD and maximal strength can decrease the threshold necessary to produce the same absolute force (15). It has been reported that high-intensity strength training induces changes in neuromuscular function, which allows an athlete to produce a greater net force with each stride, primarily as a result of increased motor unit synchronization and firing frequency (15). Therefore, an athlete can produce the same absolute force at a lower relative intensity.

In an earlier study, Hoff et al. observed a training-induced increase in RFD, which would theoretically allow for a shorter propulsion phase for a given overall force output. This shorter propulsion phase would facilitate an extended muscle relaxation phase, which would reduce the time of contraction-induced muscle occlusion (14). Theoretically, this would increase the time for muscle perfusion while increasing the mean capillary transit time (MCTT) during every stride of an endurance event. Furthermore, it has been hypothesized that an increase in MCTT could induce a glycogen sparing effect, due to increasing the time for diffusion for free fatty acids (FFA), which are large in size and would benefit from the increased time for diffusion. Hoff and colleagues argued that this training-induced effect could lead to an enhanced removal of metabolites and a reduced production of lactate (due to the glycogen sparing effect), which could potentially delay fatigue and improve the efficiency of the contracting muscle (14).

Millet et al. found that high-intensity strength training increased muscle-tendon stiffness (measured as running leg stiffness), which has been suggested to improve exercise economy (23). It is postulated that improving force transmission, due to a more optimal muscle-tendon stiffness, could contribute to the aforementioned improved efficiency of the contracting muscle. In this scenario, an increased muscle-tendon stiffness could also

facilitate an increase in MCTT, as hypothesized by Hoff et al. and Aagaard and Anderson (1,14).

LACTATE THRESHOLD

Lactate threshold (LT) can be described as the fraction of the maximal oxygen uptake at which blood lactate rapidly increases in concentration (4). The LT is generally described as a percentage of $\text{VO}_{2\text{max}}$, which has been argued to be largely unaffected by resistance training (14,15). However, multiple studies have reported an increase in velocity at the LT during anaerobic running and cycling tests (20,33). Therefore, it can be hypothesized that the LT can be increased by an improvement in work efficiency, if the athlete's body mass and absolute $\text{VO}_{2\text{max}}$ remain constant.

Mikkola et al. demonstrated an increase in all submaximal running velocities during a maximal anaerobic running test after eight weeks of explosive strength training combined with endurance training (20). This observation has been identified by other research groups through various measures, which include reports of an increased velocity at a given lactate concentration (20). Taipale et al. demonstrated an increase in running speed at the respiratory compensation threshold after the completion of eight weeks of mixed maximal and explosive strength training (38). These results indicate a positive shift in the LT, if it is assumed that the LT is a product of the athletes' $\text{VO}_{2\text{max}}$ and exercise economy (38).

In addition, it can be theorized that through an improvement in exercise economy, there will be a decrease of energy expenditure for a given amount of work (40). A decreased energy expenditure over a prolonged period of competition could result in a significant overall decrease in energy expenditure for the competition. A decreased energy expenditure could assist in maintaining glycogen stores, delaying fatigue, and ultimately, enhance performance (14,15,40). Additionally, a decrease in energy expenditure could assist in maintaining short- and long-term energy balance, which has been associated with the overtraining milieu (17).

SOME OTHER FACTORS

Running speed (V_{max}) and power output (W_{max}) at $\text{VO}_{2\text{max}}$ have been shown to predict endurance performance in well-trained endurance runners and cyclists (36). Stratton et al. demonstrated that running velocity on a treadmill at $\text{VO}_{2\text{max}}$ could predict performance in a 5,000-m run (36). V_{max} and W_{max} are products of $\text{VO}_{2\text{max}}$ and exercise economy, while incorporating significant anaerobic and neuromuscular components (36). High-intensity strength training paired with explosive, high-velocity movements has been shown to increase V_{max} , W_{max} , and time-to-exhaustion in well-trained, highly-trained, and recreationally-trained endurance athletes (20,21,22,23,30,31,32,33,38,39).

The ability to generate high power output over a short period of time is a vital component of endurance performance. This ability is magnified at certain junctures during endurance competitions such as initial positioning, closing a gap, making a pass, or during the final kick. Ronnestad et al. showed an increase in both mean and peak power output after the completion of heavy lower body

strength training (29). Of importance, Ronnestad and colleagues demonstrated that one strength training session per week could partially maintain the training-induced improvements elicited through strength training (29). Therefore, maintaining training-induced alterations can be done in a low volume manner, which would allow for proper recovery during the competition period.

Additionally, Ronnestad et al. found that 25 total weeks (10 weeks of preparatory and 15 weeks of competition) of heavy strength training led to an earlier occurrence of peak torque in the pedal stroke when considering pedal characteristics among cyclists; an occurrence not observed in the endurance training only group (33). Ronnestad and colleagues proposed a hypothesis concerning an increased duration of blood flow due to an extended relaxation phase, which, in theory, would facilitate a greater amount of blood flow to working musculature (6,29). According to this theory, the increased blood flow would increase the delivery of oxygen and substrates to the working musculature, contributing to an increase in power output at a given intensity.

PRACTICAL APPLICATION

Based on the current literature, it is suggested that endurance athletes engage in high-intensity strength training combined with explosive, high-velocity movements in order to best enhance performance (18). It is postulated that this type of training model will enhance performance through an increase in maximal strength and neuromuscular capabilities, which will result in an improvement in exercise economy and anaerobic characteristics (1,18). Furthermore, the research indicates that total training volume can be altered to prevent overtraining, while maintaining a low-volume, high-intensity strength training approach during competition periods (29).

High-intensity strength training, when paired with explosive, high-velocity movements, can elicit an improved exercise economy as a result of an increased velocity at lactate threshold, an improved lactate removal ability, and a possible increase in substrate availability, as well as the ability to maintain stride length and frequency at a given velocity (1,9,18). In addition, high-intensity strength training facilitates muscle fiber transitioning, whereby fast twitch muscle fibers develop an increased oxidative capacity, and thus, increase the oxidative capacity of the type II muscle fibers in the targeted musculature (2,18). These muscular and neuromuscular alterations serve to directly improve endurance performance.

Based on previous research, high-intensity strength training should be performed twice per week during the off-season, or periods of reduced endurance volume (18). However, during periods of competition or heightened endurance training volume, it is suggested that muscular and neuromuscular adaptations elicited by high-intensity strength training can be maintained in only one strength training session per week for a period of up to 14 weeks (29). It is recommended that a preparatory phase of at least six weeks precede the high-intensity strength training, in order to reduce the risk of injury and learn exercise technique (18,29). It can be suggested that an undulating periodized approach could effectively introduce this type of training to the athlete during the

preparatory period, while allowing the athlete to consistently train at high intensities throughout the year.

After the completion of the preparatory phase, it is advised that athletes perform strength training with loads of more than 75% 1RM involving less than six repetitions for at least 2 – 3 sets with approximately 2 – 3 min of rest between sets (18). In addition, athletes are advised to perform at least two sets of explosive, high-velocity movements. Previous research trials have primarily examined the impact of strength training on lower body musculature; however, the most beneficial strategy may be to target all major muscle groups and utilize compound ballistic movements, as generally prescribed to athletes of all sports. When implementing this type of training program, athletes should be monitored for symptoms associated with overreaching such as an extended period of “heavy legs” or “staleness,” as these are commonly associated with decrements in performance (17).

CONCLUSION

In conclusion, high-intensity strength training paired with explosive, high-velocity movements is suggested to enhance endurance performance. However, any form of resistance training is theorized to provide an ergogenic effect. It is recommended that a practical approach be taken when implementing this model of strength training, which would involve a thorough preparatory period.

REFERENCES

1. Aagaard, P, and Anderson, JL. Effects of strength training on endurance capacity in top-level endurance athletes. *Scandinavian Journal of Medicine and Science in Sports* 20(2): 39-47, 2010.
2. Aagaard, P, Anderson, J, Bennekou, M, Larsson, B, Olesen, J, Crameri, R, et al. Effects of resistance training on endurance capacity and muscle fiber composition in young top-level cyclists. *Scandinavian Journal of Medicine and Science in Sports* 21: 298-307, 2011.
3. Barnes, K, Hopkins, W, McGuigan, M, Northuis, M, and Kilding, A. Effects of resistance training on running economy and cross-country performance. *Medicine and Science in Sports and Exercise* 45(12): 2322-2331, 2013.
4. Bassett, D, and Howley, E. Limiting factors for maximum oxygen uptake and determinants of endurance performance. *Medicine and Science in Sports and Exercise* 32(1): 70-84, 2000.
5. Bastiaans, J, Van Diemen, A, Veneberg, T, and Jeukendrup, A. The effects of replacing a portion of endurance training by explosive strength training on performance in trained cyclists. *European Journal of Applied Physiology* 86(1): 79-84, 2001.
6. Bieuzen, F, Lepers, R, Vercruyssen, F, Hausswirth, C, and Brisswalter, J. Muscle activation during cycling at different cadences: Effect of maximal strength capacity. *Journal of Electromyography and Kinesiology* 17(6): 731-738, 2007.
7. Costill, D. The relationship between selected physiological variables and distance running performance. *Journal of Sports Medicine and Physical Fitness* 7(2): 61-66, 1967.
8. Damasceno, MV, Lima-Silva, AE, Pasqua, LA, Tricoli, V, Duarte, M, Bishop, DJ, and Bertuzzi, R. Effects of resistance training on neuromuscular characteristics and pacing during 10-km running time trial. *European Journal of Applied Physiology* 115(7): 1513-1522, 2015.
9. Esteve-Lanao, J, Rhea, M, Fleck, S, and Lucia, A. Running-specific, periodized strength training attenuates loss of stride length during intense endurance running. *Journal of Strength and Conditioning Research* 22(4): 1176-1183, 2008.
10. Ferrauti, A, Bergermann, M, and Fernandez-Fernandez, J. Effects of a concurrent strength and endurance training on running performance and running economy in recreational marathon runners. *Journal of Strength and Conditioning Research* 24(10): 2770-2778, 2010.
11. Hausswirth, C, Argentin, S, Bieuzen, F, Le Meur, Y, Couturier, A, and Brisswalter, J. Endurance and strength training effects on physiological and muscular parameters during prolonged cycling. *Journal of Electromyography and Kinesiology* 20(2): 330-339, 2010.
12. Hickson, R. Interference of strength development by simultaneously training for strength and endurance. *European Journal of Applied Physiology* 45(2-3): 255-263, 1980.
13. Hickson, R, Dvorak, B, Gorostiaga, E, Kurowski, T, and Foster, C. Potential for strength and endurance training to amplify endurance performance. *Journal of Applied Physiology* 65(5): 2285-2290, 1988.
14. Hoff, J, Helgerud, J, and Wisloff, U. Maximal strength training improves work economy in trained female cross-country skiers. *Medicine and Science in Sports and Exercise* 31(6): 870-877, 1999.
15. Hoff, J, Gran A, and Helgerud, J. Maximal strength training improves aerobic endurance performance. *Scandinavian Journal of Medicine and Science in Sports* 12(5): 288-295, 2002.
16. Johnston, R, Quinn, T, Kertzer, R, and Vroman, N. Strength training in female distance runners: impact on running economy. *Journal of Strength and Conditioning Research* 11(4): 224-229, 1997.
17. Lehman, M, Foster, C, and Keul, J. Overtraining in endurance athletes: A brief review. *Medicine and Science in Sports and Exercise* 25(7): 854-862, 1993.
18. Leveritt, M, Abernathy, P, Barry, B, and Logan, P. Concurrent strength and endurance training: A review. *Sports Medicine* 28(6): 413-427, 1999.
19. Levin, G, McGuigan, M, and Laursen, P. Effect on concurrent resistance and endurance training on physiologic and performance parameters of well-trained endurance cyclists. *Journal of Strength and Conditioning Research* 23(8): 2280-2286, 2009.
20. Mikkola, J, Rusko, H, Nummela, A, Pollari, T, and Hakkinen, K. Concurrent endurance and explosive type strength training improves neuromuscular and anaerobic characteristics in young distance runners. *International Journal of Sports Medicine* 28(7): 602-611, 2007.

21. Mikkola, J, Rusko, H, Nummela, A, Paavolainen, L, and Hakkinen, K. Concurrent endurance and explosive type strength training increases activation and fast force production of leg extensor muscles in endurance athletes. *Journal of Strength and Conditioning Research* 21(2): 613-620, 2007.
22. Mikkola, J, Vesterinen, V, Taipale, R, Capostagno, B, Hakkinen, K, and Nummela, A. Effect of resistance training regimens on treadmill running and neuromuscular performance in recreational endurance runners. *Journal of Sport Sciences* 29(13): 1359-1371, 2011.
23. Millet, GP, Jaouen, B, Borrani, F, and Candau, R. Effects of concurrent endurance and strength training on running economy and VO_2 kinetics. *Medicine and Science in Sports and Exercise* 34(8): 1351-1359, 2002.
24. Paavolainen, L, Hakkinen, K, and Rusko, H. Effects of explosive type strength training on physical performance characteristics in cross-country skiers. *European Journal of Applied Physiology and Occupational Physiology* 62(4): 251-255, 1991.
25. Paavolainen, L, Hakkinen, K, Hamalainen, I, Nummela, A, and Rusko, H. Explosive strength training improves 5-km running time by improving running economy and muscle power. *Journal of Applied Physiology* 86(5): 1527-1533, 1999.
26. Paavolainen, L, Nummela, A, and Rusko, H. Neuromuscular characteristics and muscle power as determinants of 5-km running performance. *Medicine and Science in Sports and Exercise* 31(1): 124-130, 1999.
27. Ratamess, NA. *Essentials of Strength Training and Conditioning*. (3rd ed.) Champaign, IL: Human Kinetics; 94-119, 2008.
28. Ronnestad, B, Hansen, E, and Raastad, T. Effect of heavy strength training on thigh muscle cross-sectional area, performance determinants, and performance in well-trained cyclists. *European Journal of Applied Physiology* 108(5): 965-975, 2010.
29. Ronnestad, B, Hansen, E, and Raastad, T. In-season strength maintenance training increases well-trained cyclists' performance. *European Journal of Applied Physiology* 110(6): 1269-1282, 2010.
30. Ronnestad, B, Hansen, E, and Raastad, T. Strength training improves 5-min all-out performance following 185 min of cycling. *Scandinavian Journal of Medicine and Science in Sports*. 21(2): 250-259, 2011.
31. Ronnestad, B, Hansen, E, and Raastad, T. High volume of endurance training impairs adaptations to 12 weeks of strength training in well-trained endurance athletes. *European Journal of Applied Physiology* 112(4): 1457-1466, 2012.
32. Ronnestad, B, Kojedal, O, Losnegard, T, Kvamme, B, and Raastad, T. Effect of heavy strength training on muscle thickness, strength, jump performance, and endurance performance in well-trained Nordic Combined athletes. *European Journal of Applied Physiology* 112(6): 2341-2352, 2012.
33. Ronnestad, B, Hansen, J, Hollan, I, and Ellefsen, S. Strength training improves performance and pedaling characteristics in elite cyclists. *Scandinavian Journal of Medicine and Science in Sports* 25(1): 89-98, 2015.
34. Saunders, P, Pyne, D, Telford, R, and Hawley, J. Factors affecting running economy in trained distance runners. *Sports Medicine* 34(7): 465-485, 2004.
35. Storen, O, Helgerud, J, Stoa, E, and Hoff, J. Maximal strength training improves running economy in distance runners. *Medicine and Science in Sports and Exercise* 40(6): 1087-1092, 2008.
36. Stratton, E, O'Brien, B, Harvey, J, Blitvich, J, McNicol, A, Janissen, D, et al. Treadmill velocity best predicts 5000-m run performance. *International Journal of Sports Medicine* 30(1): 40-45, 2009.
37. Taipale, R, Mikkola, J, Nummela, A, Vesterinen, V, Capostagno, B, Walker, S, et al. Strength training in endurance runners. *International Journal of Sports Medicine* 31(7): 468-476, 2010.
38. Taipale, R, Mikkola, J, Vesterinen, V, Nummela, A, and Hakkinen, K. Neuromuscular adaptations during combined strength and endurance training in endurance runners: Maximal versus explosive strength training or a mix of both. *European Journal of Applied Physiology* 113(2): 325-335, 2013.
39. Taipale, RS, Mikkola, J, Salo, T, Hokka, L, Vesterinen, V, Kraemer, WJ, et al. Mixed maximal and explosive strength training in recreational endurance runners. *Journal of Strength and Conditioning Research* 28(3): 689-699, 2014.
40. Tanaka, H, and Swensen, T. Impact of resistance training on endurance performance: A new form of cross training? *Sports Medicine* 25(3): 191-200, 1998.
41. Turner, A, Owings, M, and Schwane, J. Improvement in running economy after 6 weeks of plyometric training. *Journal of Strength and Conditioning Research* 17(1): 60-67, 2003.
42. Wilson, J, Marin, P, Rhea, M, Wilson, S, Loenneke, J, and Anderson, J. Concurrent training: A meta-analysis examining interference of aerobic and resistance exercise. *Journal of Strength and Conditioning Research* 26(8): 2293-2307, 2012.

ABOUT THE AUTHOR

Marc Lewis is the co-owner of Winston Salem Personal Training, as well as a graduate teaching and research assistant at the University of South Carolina in the Department of Exercise Science. He completed his Bachelor of Science degree in Exercise Science from Wake Forest University, while serving as a research assistant in exercise physiology under Dr. Michael Berry. He has instructed courses covering exercise physiology, clinical exercise physiology, and strength and conditioning. Lewis holds numerous certifications, such as being recognized as a Certified Strength and Conditioning Specialist® (CSCS®) through the National Strength and Conditioning Association (NSCA). He has published peer-reviewed research in exercise physiology, as well as authored guest articles for various fitness professionals. His research interests concern concurrent training and its application for athletic performance.

TABLE 1. SAMPLE TRAINING SCHEDULE FOR COMPETITIVE DISTANCE RUNNER

TIME OF DAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Morning	Long run	Repetition training	Rest/off day with active recovery	Long run	Program B	Rest/off	Interval training
Afternoon/ Evening	Rest/off	Program A	Rest/off day with active recovery	Active recovery	Active recovery	Tempo/ pace run	Rest/off

TABLE 2. SAMPLE PROGRAM A (POST-PREPARATORY PERIOD)

EXERCISE	SETS	REPS	INTENSITY	REST
Bench presses	3	5	75% 1RM	2 – 3 min
Back squats	3	5	75% 1RM	2 – 3 min
Romanian deadlifts (RDL)	3	5	Movement skill*	2 – 3 min
Lateral lunges (dumbbell)	3	6	Rating of Perceived Exertion (RPE) 14 – 16	2 – 3 min
Pull-ups	3	6	Use band or machine assistance as necessary	2 – 3 min

*Begin with a medicine ball or kettlebell to learn weight shift, postural alignment, and hip hinge, then progress accordingly with loading.

TABLE 3. SAMPLE PROGRAM B (POST-PREPARATORY PERIOD)

EXERCISE	SETS	REPS	INTENSITY	REST
Push presses	3	5	75% 1RM*	2 – 3 min
High pulls	3	5	Movement skill**	2 – 3 min
Glute/ham raises	3	5	RPE 14 – 16 with banded resistance and isometric hold	2 – 3 min
Lunges (dumbbell)	3	6	RPE 14 – 16	2 – 3 min
Bulgarian split squats (dumbbell)	3	6	RPE 14 – 16	2 – 3 min

*This can be an estimated 1RM from the preparatory period.

**Teach the movement and add weight accordingly while allowing the athlete to move the load with maximal velocity and an appropriate intensity of effort (RPE 14 – 16).



FISH OIL SUPPLEMENTATION AND AGE-RELATED DECREMENTS IN MUSCLE MASS AND FUNCTION—A POTENTIAL ROLE FOR OMEGA-3S IN PREVENTING SARCOPENIA

DYLAN KLEIN, PHD(C)

INTRODUCTION AND BACKGROUND

Long-chain omega-3 polyunsaturated fatty acids (n-3 PUFAs) (i.e., eicosapentanoic acid [EPA] and docosahexanoic acid [DHA]) have garnered much attention over recent years due to their potential beneficial effects on cardiovascular health. Leaving cardiovascular health aside, emerging evidence has suggested another beneficial role for omega-3 fatty acids with regards to the preservation of, as well as increases in, skeletal muscle mass (28). This is of particular relevance to the elderly (i.e., those 60 years and older) who display age-related declines in muscle mass and function, which directly contribute to frailty and disability, the increased risk of falls and hospitalization stays, and decreases in functionality and overall quality of life (14,16,29,36,47).

In the United States, it is estimated that the population of those over 60 years old will double to 112 million by 2050 (i.e., over 20% of the U.S. population) (33). This represents a large expansion of the elderly population that will undoubtedly have profound effects on healthcare and the corresponding medical and professional fields. The aging process is partly characterized by a progressive and concomitant loss of skeletal muscle mass and strength that leads to decrements in functionality and overall quality of life (8). Moreover, aging is also accompanied by a low-grade inflammatory state, often referred to as “inflamm-aging,” that likely contributes to the loss of lean tissue and the progression of other comorbidities (e.g., type 2 diabetes mellitus) (9). It has been calculated that from age 20 to age 80 muscle mass can be reduced by almost 30% from peak values, with even greater losses in muscle strength and function that can directly affect daily activities such as standing and walking (5,10). This severe loss in lean body mass and muscle function (collectively termed, sarcopenia) is highly correlated with the increased risk of falls, hospitalization, comorbidity (e.g., fractures, cardiovascular disease, and diabetes), and overall mortality (35). While sarcopenia has not yet been well-defined and many different criteria exist to classify someone as sarcopenic, upwards of 45 – 50% of the elderly

population may exhibit, to some degree, age-associated muscle wasting, loss of strength, and disability/frailty (2). Regarding healthcare expenses, in 2004 it was estimated that sarcopenia alone accounted for over \$18 billion in direct healthcare costs (19). A 10% reduction in sarcopenia prevalence could translate into saving \$1.1 billion. Thus, sarcopenia not only affects the individual, but society as a whole, and its reduction in prevalence can translate into real healthcare savings.

Given the rapidly expanding elderly population, the prevalence and financial impact of age-related muscle wasting, and very few accepted methods to treat sarcopenia in the elderly, novel dietary treatments must be researched and implemented in order to prevent and/or treat sarcopenia. Fish oil supplementation appears that it may be a safe, effective, and novel dietary treatment for the prevention and possibly even remediation of age-related muscle wasting in the elderly.

WHAT IS SARCOPENIA?

Humans rely heavily upon the locomotive, oxidative, and force generative properties of skeletal muscle for daily activities such as walking, eating, and breathing. Furthermore, skeletal muscle is of major importance to human health and survival (e.g., glucose disposal and locomotion to undertake daily activities). Indeed, reductions in skeletal muscle mass, strength, and functionality are associated with increased disability, comorbidity, and mortality. Collectively, decrements in muscle mass and functions are termed sarcopenia (from the Greek words *sarcos*, meaning “flesh,” and *penia*, meaning “a lack of”). Classically, sarcopenia was used to simply describe the age-associated loss of muscle mass and strength (40). This was proposed over 25 years ago by Dr. Irwin H. Rosenberg in an effort to bring attention to the increasing evidence that a loss of muscle mass may be leading to the increased risk for injury and hospitalization seen in the elderly. Presently, while no universal definition of sarcopenia exists, a handful of recent consensus papers have made strides in formulating what can be considered a general agreement as to what constitutes sarcopenia (8,35).

Briefly, sarcopenia is accepted to be a condition that is associated with the aging process and results in a concomitant loss of muscle mass, strength, and function that leads to increased disability, comorbidity, and mortality. Moreover, these conditions can happen apart from or in tandem with an increase in fat mass—a condition referred to as “sarcopenic obesity,” which may place the elderly at even greater risk of disability, hospitalization, and overall death than sarcopenia alone (44). The etiology of sarcopenia is even less well defined, with numerous factors such as poor diet and inactivity/disuse, alterations in the hormonal milieu and protein metabolism, and chronic, low-grade inflammation all being listed as potential causal candidates (8). As it stands, much is to be elucidated about the etiology and pathogenesis of age-associated muscle wasting. Nevertheless, it is safe to say that sarcopenia is likely a combination of all these mitigating factors and not just one single factor in isolation from the rest.

MUSCLE LOSSES THAT OCCUR ALONGSIDE AGING

Quantifying the loss of skeletal muscle mass that occurs with old age has not been conclusive with estimates averaging ~30% between the ages of 20 and 80 years (10). Further, it appears that men lose ~4.7% and women ~3.7% of their peak skeletal muscle mass every 10 years (27). These losses, however, are neither linear nor uniform across time with regard to the body compartments (i.e., upper vs. lower body). Indeed, lower body lean mass is reduced at over twice the rate as upper body lean mass (6,11,17). Moreover, men seem to lose more muscle than women, both in terms of absolute muscle mass, as well as relative to peak values (11). Be that as it may, there is evidence to suggest that women may actually suffer the consequences of sarcopenia (e.g., disability and functional impairment) more frequently than men (18).

As stated before, sarcopenia is not solely a loss of lean body mass, but rather a loss of lean tissue, muscle strength, and functionality that affects a large proportion of both sexes in old age. Thus, strength and functional outcomes must also be considered given that the decrements in muscle strength and function far surpass losses in lean mass (2 – 5% per year vs. 0.5 – 1%, respectively) and are better correlated with disability and mortality (27). Given this insight, one could argue that muscle strength and functionality might be more important than muscle mass with regard to the health and survival of the individual (i.e., what is the use of increased muscle mass—or maintenance thereof—if functionality and quality of life still decline?). To this point, it has been shown that strength (as measured by hand dynamometry or knee extensor strength) is a far better indicator of disability and future mortality than muscle mass alone (27). However, when eccentric contraction (i.e., the lengthening portion of a lift) is considered in isolation from the concentric (i.e., shortening) portion of contraction, there is a paradoxical maintenance, and possibly even increase in strength with older age (20). While initially paradoxical, it has been shown that there is an increase in non-contractile elements within the skeletal muscle and tendon that makes them rigid and stiff with old age, allowing for a supposed maintenance/increase in eccentric strength that is independent of innervation and motor unit recruitment (38).

Aside from decrements in muscle mass, strength, and function, it has also been shown that there are apparent changes in the muscle architecture and morphology during the aging process that

may, in part, contribute to the declines in strength and function that are seen (27). Indeed, it has been shown that muscle fibers, compared to younger individuals, are shorter, thinner and in less abundance in the elderly, which can potentially contribute to alterations in muscle function and capacity. While important, these factors will not be looked at in any further depth in this article.

GENETIC INSIGHTS

To date, there is very little convincing data to suggest that sarcopenia has a genetic cause (12). While few candidate genes have been identified (e.g., angiotensin converting enzyme I, alpha actinin 3, myostatin, ciliary neurotrophic factor, and vitamin D receptor), none stand out alone or in conjunction with one another as a strong candidate(s) for a causal role in the pathogenesis of sarcopenia (45).

METABOLIC INSIGHTS

Alterations in muscle protein balance have been implicated in the pathogenesis of sarcopenia and have received the bulk of sarcopenia research attention. Indeed, it has been shown numerous times that, compared to healthy young persons, the elderly display a “blunting” of the anabolic response to a meal/ amino acids and exercise which likely contributes to a situation wherein muscle protein breakdown (MPB) outweighs muscle protein synthesis (MPS) and leads to an overall loss of skeletal muscle mass over time (5,7,21,22). This is especially prevalent in the face of reduced calorie and protein intakes that are typically seen in the elderly (27). This phenomenon has been called “anabolic resistance” and has been a central focus of much of the protein and aging research. However, despite its appealing nature, the anabolic resistance seen in the elderly is not likely to be the sole driver of the increased disability and mortality associated with aging. As stated before, it has been shown that, while muscle mass and strength decrease in parallel, it is the loss of muscle strength and function that declines more rapidly (~2 – 5 times faster) and is better associated with the increased risk of overall death rather than muscle mass. Thus, interventions aimed solely at targeting MPS (and/or MPB) may be naively neglecting the numerous other mitigating factors that contribute to the progression and worsening of sarcopenia in the elderly. Indeed, acute increases in MPS are not completely predictive of long-term accretion of muscle mass and even less so of strength and functional outcomes (24,26). To this end, studies utilizing exogenous androgen administration (e.g., testosterone [T] and growth hormone [GH]) have shown that, while hormone replacement therapy does indeed increase muscle mass and reduce body fat stores, these beneficial alterations in body composition do not translate into concrete improvements in strength, power, or functional outcomes such as walking speed or rising from a chair (30). Moreover, doses at which exogenous androgens must be administered are relatively high, thereby bringing the safety of such treatments into question, especially those with prostate cancer or cardiovascular disease wherein exogenous androgens such as T are contraindicated (39).

“INFLAMM-AGING”

Finally, it has been shown that aging is also characterized by the presence of a chronic, low-grade inflammation, as well as oxidative damage (25). This is collectively termed the inflammation of aging or “inflamm-aging” (9). Studies have revealed that the increases in inflammation and oxidative damage are associated with

FISH OIL SUPPLEMENTATION AND AGE-RELATED DECREMENTS IN MUSCLE MASS AND FUNCTION—A POTENTIAL ROLE FOR OMEGA-3S IN PREVENTING SARCOPENIA

decrements in strength and possibly muscle function, as well as cachexia that collectively point to a potential causal role in the pathogenesis of sarcopenia (3,15).

ROLE FOR OMEGA-3 FISH OILS IN THE PREVENTION/TREATMENT OF SARCOPENIA

It has been shown that the fatty acid composition of skeletal muscle closely reflects that of the diet in humans (4). However, the elderly may be at risk for reduced intakes of n-3 long-chain PUFAs given their lowered overall nutrient intake. Further, n-3 PUFAs have shown enormous promise with regards to increasing rates of MPS in the elderly, as well as potentiating the effects of resistance training on strength and functional outcomes relevant to increasing the quality of life in the elderly. To date, however, it is unknown whether or not older sarcopenic individuals have lower skeletal muscle content of n-3 PUFAs (EPA and DHA) compared to both the non-sarcopenic healthy elderly, as well as healthy younger individuals, and if these potential decrements in tissue n-3 PUFAs are related to the observed reductions in functional outcomes such as strength and walking speed. Nonetheless, in a single cross-sectional study evaluating the relationship between plasma free fatty acids and lower extremity performance, people with higher baseline levels of plasma PUFAs, including n-3, were shown to have greater lower extremity physical performance than those with lower baseline levels (1). Further, a higher n-6 to n-3 ratio was shown to increase the risk for developing poorer lower extremity physical function whereas baseline n-3 levels were inversely related to risk for developing poor lower extremity physical function over a subsequent 3-year period. Thus, there is preliminary data to suggest that n-3 PUFAs play a role in the aging process and that fish oil supplementation may be beneficial with regards to preventing/treating sarcopenia.

EFFICACY OF OMEGA-3 FISH OILS IN THE ELDERLY

Over the past decade fish oil, a known mediator of the inflammatory response, has received increasing attention as a potential nutritional agent for the treatment of various diseases due to its inflammatory and anabolic/anticatabolic properties with regards to skeletal muscle biology. Indeed, numerous studies in cell culture, murine models, and human trials lend valuable insight into omega-3's putative role in preventing and possibly even treating sarcopenia. In burned rats and tumor-bearing mice, fish oil supplementation alone or in combination with amino acids can improve whole body protein synthesis and maintain skeletal muscle mass (13,46). Further, in humans, esophageal cancer patients undergoing surgery and receiving enteral formulas with additional EPA saw a preservation of lean body mass (41). Also, Smith and colleagues showed that n-3 PUFA supplementation (4 g/day) was able to increase muscle protein synthesis (MPS) rates to a greater extent in the elderly (>65 years) in response to hyperaminoacidemia-hyperinsulinemia (42). While the molecular basis for these anabolic/anticatabolic properties is not fully established, there is a common thread that underlies each condition: a mild to moderate inflammatory state. Indeed, cancer,

burn injury, and aging are all characterized by an inflammatory state, which has been shown to be associated with losses in muscle mass. Indeed, simply reducing low-grade inflammation by administering a common non-steroidal anti-inflammatory drug (NSAID) for 5 months in aging rats was able to increase rates of MPS and reduce the losses in lean body mass (34). Nonetheless, sarcopenia is not simply a condition of muscle wasting as there are substantial decrements in muscle strength and function that far surpass the losses in muscle mass. Thus, sarcopenia is truly a condition of disability and loss of function. In this regard, fish oil supplementation in rats has been shown to increase ileal contractility that is likely due to increased n-3 PUFA composition of the cellular membrane that leads to increased receptor sensitivity, while fish oil supplementation (2 g/day) in elderly women was shown to potentiate the effects of chronic resistance training on strength and certain functional outcomes compared to just training alone (31,32,37). Conversely, trans-fatty acid (TFA) supplementation in a mouse model of sarcopenia (SAMP8) was shown to worsen functional outcomes compared to sarcopenic controls on a standard diet with very little TFA (23). Thus, there is reason to believe that fish oils can improve muscle mass and increase functional outcomes by way of incorporating into cellular membranes and thereby alleviating the inflammatory state and enhancing intracellular signaling, as well as improving skeletal muscle innervation at the level of the nervous system. Finally, more recently, Smith et al. showed in a double-blind randomized controlled trial of elderly individuals (60 – 85 years old) that 4 g/day of fish oil for 6 months, in the absence of any structured diet or exercise routine, improved thigh muscle volume (as measured by MRI), hand grip strength, and 1RM muscle strength (composite score of leg press, chest press, leg extensions, and curls) compared to placebo (4 g/day of corn oil) (43).

SUMMARY AND CONCLUSIONS

In conclusion, it would appear that there is a potential therapeutic role for n-3 PUFAs with regards to age-associated decrements in muscle mass and function. Evidence suggests that fish oils can increase the anabolic effects of a meal as well as increase the effects of strength training compared to just strength training alone in the elderly. Moreover, the effects of fish oil on strength and functional outcomes may even be evident in the absence of a structured resistance-training program. These effects may, in part, be due to fish oil's mediation of the chronic and low-grade inflammatory state that characterizes old age and/or through its incorporation into cell membranes thereby altering their responsiveness to neuronal inputs. While the few clinical trials that have been conducted used fish oil supplements (i.e., capsules delivering ~4 g/day of n-3 PUFAs; 1.9 g EPA and 1.5 g DHA), this intake can easily be reached through other dietary means such as fatty fish intake (e.g., 200 – 400 g [-7 – 14 oz] salmon, sardines, or herring). Thus, as it stands, n-3 PUFAs may play a pivotal role in attenuating the age-related losses in muscle mass and function although many more long-term studies are needed to conclude the effectiveness of fish oil as a preventative and possibly even curative nutritional agent for sarcopenia in the elderly.

REFERENCES

1. Abbatecola, AM, Cherubini, A, Guralnik, JM, Andres Lacueva, C, Ruggiero, C, Maggio, M, Bandinelli, S, Paolisso, G, and Ferrucci, L. Plasma polyunsaturated fatty acids and age-related physical performance decline. *Rejuvenation Research* 12: 25-32, 2009.
2. Abellan van Kan, G. Epidemiology and consequences of sarcopenia. *Journal of Nutrition, Health, and Aging* 13: 708-712, 2009.
3. Ali, S, and Garcia, JM. Sarcopenia, cachexia and aging: Diagnosis, mechanisms and therapeutic options - A mini-review. *Gerontology* 60: 294-305, 2014.
4. Andersson, A, Nalsen, C, Tengblad, S, and Vessby, B. Fatty acid composition of skeletal muscle reflects dietary fat composition in humans. *American Journal of Clinical Nutrition* 76: 1222-1229, 2002.
5. Balagopal, P, Rooyackers, OE, Adey, DB, Ades, PA, and Nair, KS. Effects of aging on in vivo synthesis of skeletal muscle myosin heavy-chain and sarcoplasmic protein in humans. *American Journal of Physiology* 273: E790-800, 1997.
6. Borkan, GA, Hulth, DE, Gerzof, SG, Robbins, AH, and Silbert, CK. Age changes in body composition revealed by computed tomography. *Journal of Gerontology* 38: 673-677, 1983.
7. Cuthbertson, D, Smith, K, Babraj, J, Leese, G, Waddell, T, Atherton, P, Wackerhage, H, Taylor, PM, and Rennie, MJ. Anabolic signaling deficits underlie amino acid resistance of wasting, aging muscle. *FASEB J* 19: 422-424, 2005.
8. Fielding, RA, Vellas, B, Evans, WJ, Bhasin, S, Morley, JE, Newman, AB, Abellan van Kan, G, Andrieu, S, Bauer, J, Breuille, D, et al. Sarcopenia: An undiagnosed condition in older adults. Current consensus definition: prevalence, etiology, and consequences. International working group on sarcopenia. *Journal of American Medical Directors Association* 12: 249-256, 2011.
9. Franceschi, C, and Campisi, J. Chronic inflammation (inflammaging) and its potential contribution to age-associated diseases. *Journal of Gerontology Series A: Biological Sciences and Medical Sciences* 69 Suppl 1: S4-9, 2014.
10. Frontera, WR, Hughes, VA, Fielding, RA, Fiatarone, MA, Evans, WJ, and Roubenoff, R. Aging of skeletal muscle: A 12-yr longitudinal study. *Journal of Applied Physiology* 88:1321-1326, 2000.
11. Gallagher, D, Visser, M, De Meersman, RE, Sepulveda, D, Baumgartner, RN, Pierson, RN, Harris, T, and Heymsfield, SB. Appendicular skeletal muscle mass: Effects of age, gender, and ethnicity. *Journal of Applied Physiology* 83: 229-239, 1997.
12. Garatachea, N, and Lucia, A. Genes and the ageing muscle: A review on genetic association studies. *Age* 35: 207-233, 2013.
13. Hayashi, N, Tashiro, T, Yamamori, H, Takagi, K, Morishima, Y, Otsubo, Y, Sugiura, T, Furukawa, K, Nitta, H, Nakajima, N, et al. Effect of intravenous omega-6 and omega-3 fat emulsions on nitrogen retention and protein kinetics in burned rats. *Nutrition* 15: 135-139, 1999.
14. Hicks, GE, Shardell, M, Alley, DE, Miller, RR, Bandinelli, S, Guralnik, J, Lauretani, F, Simonsick, EM, and Ferrucci, L. Absolute strength and loss of strength as predictors of mobility decline in older adults: the InCHIANTI study. *Journal of Gerontology Series A: Biological Sciences and Medical Sciences* 67: 66-73, 2012.
15. Howard, C, Ferrucci, L, Sun, K, Fried, LP, Walston, J, Varadhan, R, Guralnik, JM, and Semba, RD. Oxidative protein damage is associated with poor grip strength among older women living in the community. *Journal of Applied Physiology* 103: 17-20, 2007.
16. Ishizaki, T, Watanabe, S, Suzuki, T, Shibata, H, and Haga, H. Predictors for functional decline among nondisabled older Japanese living in a community during a 3-year follow-up. *Journal of American Geriatrics Society* 48: 1424-1429, 2000.
17. Janssen, I, Heymsfield, SB, Wang, ZM, and Ross, R. Skeletal muscle mass and distribution in 468 men and women aged 18-88 yr. *Journal of Applied Physiology* 89: 81-88, 2000.
18. Janssen, I, Heymsfield, SB, and Ross, R. Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. *Journal of American Geriatric Society* 50: 889-896, 2002.
19. Janssen, I, Shepard, DS, Katzmarzyk, PT, and Roubenoff, R. The healthcare costs of sarcopenia in the United States. *Journal of American Geriatric Society* 52: 80-85, 2004.
20. Klass, M, Baudry, S, and Duchateau, J. Aging does not affect voluntary activation of the ankle dorsiflexors during isometric, concentric, and eccentric contractions. *Journal of Applied Physiology* 99: 31-38, 2005.
21. Kumar, V, Selby, A, Rankin, D, Patel, R, Atherton, P, Hildebrandt, W, Williams, J, Smith, K, Seynnes, O, Hiscock, N, and Rennie, MJ. Age-related differences in the dose-response relationship of muscle protein synthesis to resistance exercise in young and old men. *Journal of Physiology* 587: 211-217, 2009.
22. Kumar, V, Atherton, P, Smith, K, and Rennie, MJ. Human muscle protein synthesis and breakdown during and after exercise. *Journal of Applied Physiology* 106: 2026-2039, 2009.
23. Liou, J, Tuazon, MA, Burdzy, A, and Henderson, GC. Moderate compared to low dietary intake of trans-fatty acids impairs strength of old and aerobic capacity of young SAMP8 mice in both sexes. *Lipids* 48: 1135-1143, 2013.
24. Mayhew, DL, Kim, JS, Cross, JM, Ferrando, AA, and Bamman, MM. Translational signaling responses preceding resistance training-mediated myofiber hypertrophy in young and old humans. *Journal of Applied Physiology* 107: 1655-1662, 2009.
25. Mecocci, P, Fano, G, Fulle, S, MacGarvey, U, Shinobu, L, Polidori, MC, Cherubini, A, Vecchiet, J, Senin, U, and Beal, MF. Age-dependent increases in oxidative damage to DNA, lipids, and proteins in human skeletal muscle. *Free Radical Biology and Medicine* 26: 303-308, 1999.

FISH OIL SUPPLEMENTATION AND AGE-RELATED DECREMENTS IN MUSCLE MASS AND FUNCTION—A POTENTIAL ROLE FOR OMEGA-3S IN PREVENTING SARCOPENIA

26. Mitchell, CJ, Churchward-Venne, TA, Parise, G, Bellamy, L, Baker, SK, Smith, K, Atherton, PJ, and Phillips, SM. Acute post-exercise myofibrillar protein synthesis is not correlated with resistance training-induced muscle hypertrophy in young men. *PLoS One* 9: e89431, 2014.
27. Mitchell, WK, Williams, J, Atherton, P, Larvin, M, Lund, J, and Narici, M. Sarcopenia, dynapenia, and the impact of advancing age on human skeletal muscle size and strength; A quantitative review. *Frontiers in Physiology* 3: 260, 2012.
28. Molfino, A, Gioia, G, Rossi Fanelli, F, and Muscaritoli, M. The role for dietary omega-3 fatty acids supplementation in older adults. *Nutrients* 6: 4058-4073, 2014.
29. Moreland, JD, Richardson, JA, Goldsmith, CH, and Clase, CM. Muscle weakness and falls in older adults: A systematic review and meta-analysis. *Journal of American Geriatrics Society* 52: 1121-1129, 2004.
30. O'Connell, MD, and Wu, FC. Androgen effects on skeletal muscle: Implications for the development and management of frailty. *Asian Journal of Andrology* 16: 203-212, 2014.
31. Patten, GS, Abeywardena, MY, McMurchie, EJ, and Jahangiri, A. Dietary fish oil increases acetylcholine- and eicosanoid-induced contractility of isolated rat ileum. *Journal of Nutrition* 132: 2506-2513, 2002.
32. Patten, GS, Adams, MJ, Dallimore, JA, and Abeywardena, MY. Dietary fish oil dose-response effects on ileal phospholipid fatty acids and contractility. *Lipids* 40: 925-929, 2005.
33. Projections of the population by age and sex for the United States: 2010-2050 (Bureau USC ed.) 2008.
34. Rieu, I, Magne, H, Savary-Auzeloux, I, Averous, J, Bos, C, Peyron, MA, Combaret, L, and Dardevet, D. Reduction of low grade inflammation restores blunting of postprandial muscle anabolism and limits sarcopenia in old rats. *Journal of Physiology* 587: 5483-5492, 2009.
35. Rizzoli, R, Reginster, JY, Arnal, JF, Bautmans, I, Beaudart, C, Bischoff-Ferrari, H, Biver, E, Boonen, S, Brandi, ML, Chines, A, et al. Quality of life in sarcopenia and frailty. *Calcified Tissue International* 93:101-120, 2013.
36. Roberts, HC, Syddall, HE, Cooper, C, and Aihie Sayer, A. Is grip strength associated with length of stay in hospitalized older patients admitted for rehabilitation? Findings from the Southampton grip strength study. *Age Ageing* 41:641-646, 2012.
37. Rodacki, CL, Rodacki, AL, Pereira, G, Naliwaiko, K, Coelho, I, Pequeto, D, and Fernandes, LC. Fish-oil supplementation enhances the effects of strength training in elderly women. *American Journal of Clinical Nutrition* 95: 428-436, 2012.
38. Roig, M, Macintyre, DL, Eng, JJ, Narici, MV, Maganaris, CN, and Reid, WD. Preservation of eccentric strength in older adults: Evidence, mechanisms and implications for training and rehabilitation. *Experimental Gerontology* 45: 400-409, 2010.
39. Rolland, Y, Onder, G, Morley, JE, Gillette-Guyonnet, S, Abellan van Kan, G, and Vellas, B. Current and future pharmacologic treatment of sarcopenia. *Clinical Geriatric Medicine* 27: 423-447, 2011.
40. Rosenberg, IH. Sarcopenia: Origins and clinical relevance. *Clinical Geriatric Medicine* 27: 337-339, 2011.
41. Ryan, AM, Reynolds, JV, Healy, L, Byrne, M, Moore, J, Brannelly, N, McHugh, A, McCormack, D, and Flood, P. Enteral nutrition enriched with eicosapentaenoic acid (EPA) preserves lean body mass following esophageal cancer surgery: Results of a double-blinded randomized controlled trial. *Annals of Surgery* 249: 355-363, 2009.
42. Smith, GI, Atherton, P, Reeds, DN, Mohammed, BS, Rankin, D, Rennie, MJ, and Mittendorfer, B. Dietary omega-3 fatty acid supplementation increases the rate of muscle protein synthesis in older adults: a randomized controlled trial. *American Journal of Clinical Nutrition* 93: 402-412, 2011.
43. Smith, GI, Julliard, S, Reeds, DN, Sinacore, DR, Klein, S, and Mittendorfer, B. Fish oil-derived n-3 PUFA therapy increases muscle mass and function in healthy older adults. *American Journal of Clinical Nutrition* 102: 115-122, 2015.
44. Stenholm, S, Harris, TB, Rantanen, T, Visser, M, Kritchevsky, SB, and Ferrucci, L. Sarcopenic obesity: Definition, cause, and consequences. *Current Opinion in Clinical Nutrition and Metabolic Care* 11: 693-700, 2008.
45. Tan, LJ, Liu, SL, Lei, SF, Papasian, CJ, and Deng, HW. Molecular genetic studies of gene identification for sarcopenia. *Human Genetics* 131: 1-31, 2012.
46. van Norren, K, Kegler, D, Argiles, JM, Luiking, Y, Gorselink, M, Laviano, A, Arts, K, Faber, J, Jansen, H, van der Beek, EM, and van Helvoort, A. Dietary supplementation with a specific combination of high protein, leucine, and fish oil improves muscle function and daily activity in tumour-bearing cachectic mice. *British Journal of Cancer* 100: 713-722, 2009.
47. Wolfson, L, Judge, J, Whipple, R, and King, M. Strength is a major factor in balance, gait, and the occurrence of falls. *Journal of Gerontology Series A: Biological Sciences and Medical Sciences* 50A: 64-67, 1995.

ABOUT THE AUTHOR

Dylan Klein earned his Bachelor of Science degree in Nutritional Sciences, Dietetics from Rutgers University, where he is currently pursuing his Doctorate in Nutritional Biochemistry and Physiology. His research currently focuses on the molecular adaptations of skeletal muscle to exercise. In addition, Klein was also the Head Nutritionist for the Rutgers football team for the 2012 – 2013 season and the Assistant Nutritionist for the 2011 – 2012 season. In addition, Klein was the Head Nutritionist for the Rutgers' Army Reserve Officers' Training Corps (ROTC) program from 2011 – 2013. Outside of his role as a nutritionist on campus, Klein also works with the lay public, both in person and via email/phone correspondence where he specializes in fat loss, muscle gain, and body recomposition. He also provides more information on a blog called "Calories in Context."



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TRADITIONAL VERSUS MINIMALIST FOOTWEAR—INJURY CONCERNS

ANDY CHASSÉ, MS

Minimalist footwear in its most basic form, bare feet, has existed in training for thousands of years. Only recently has the footwear industry transformed it into the current saturated and complex state it is in now. The number of footwear options grows annually, and traditional footwear is no longer the only option. A recent editorial detailed the sudden surge of interest in minimalist footwear, attributing a number of studies published in the early 2000s along with the best-selling book, *Born to Run*, as major causes for this trend (8).

Today, a debate centered on whether or not traditional footwear has contributed to an increased risk of injury continues to rage throughout the scientific and footwear communities. Recent research provides support for both sides of the discussion and remains somewhat inconclusive. This article will focus on interpreting the current literature in order to provide strength and conditioning professionals with useful information that can be used for their clients.

First, a few basic definitions of traditional and minimalist footwear should be reviewed. Traditional footwear has been defined as “having a cushioned elevated heel, arch supports, and a stiff sole,” (11). On the other hand, minimalist footwear features “smaller heels, little to no cushioning, more flexible soles, and no built-in arch supports,” (9). Similarly, minimalist footwear has also been defined as simply lacking the primary characteristics of traditional footwear (11).

FOOT STRIKE CONCERNS

Foot strike is an area of concern when considering the potential injury risk of minimalist footwear. Research examining collegiate cross-country runners found that those who used a rearfoot strike, as opposed to a midfoot or forefoot strike, had a significantly higher rate of injury (4). Additional studies have quantified some possible reasons for this potential increase in injury risk. Regarding compressive loading forces at various joints, one such study found that forefoot strikers, in addition to experiencing higher ankle joint moments during the initial portion of the stance phase, received a 41.7% increase in contact forces at the ankle and a 14.4% increase at the knee (12). In a study comparing various foot strike options, those utilizing a barefoot midfoot and barefoot forefoot strike experienced significant increases in medial gastrocnemius electromyography (EMG), peak tibial shock forces, and minimum angle of knee flexion (10).

When transitioning from traditional to minimalist footwear, it is always recommended to use a cautious approach. As far as foot strike is concerned, clients should be aware of the possibility that their current foot strike pattern may not be as biomechanically efficient with minimalist footwear as with traditional shoes, especially if using a rearfoot strike pattern. This sudden change with a rearfoot strike may increase the risk of injury due to the increased muscle activity and pressures. Clients should understand that foot strike patterns other than rearfoot do not necessarily

come with a higher inherent risk of injury, but that a sudden transition may cause complications and compensations.

ACHILLES TENDON FORCES

Aggravation of the Achilles tendon region is another major concern for users of minimalist footwear. Some research has quantified the prevalence and possible underlying mechanisms of Achilles tendon injuries. In three case studies involving runners transitioning to minimalist footwear, two experienced Achilles tendinopathy and were forced to spend several weeks in rehabilitation (3). Though reductions have been shown in patellofemoral reaction forces, Achilles tendon forces have been shown to increase significantly with minimalist footwear (14). A similar study reported greater ankle plantar flexion moments, as well as an increase in positive work and peak power at the ankle joint, supporting the need to pay specific attention to the ankle complex and Achilles tendon region when using minimalist footwear (2). However, other research in this domain has provided some contradictions. In a survey of runners, more than half of the 500 respondents reported increased pain around the Achilles tendon during the transition from traditional to minimalist footwear, but participants also mentioned that this pain decreased over time and eventually ceased completely (6).

Strength and conditioning professionals should explain to their clients that minimalist footwear lacks the raised heel of traditional footwear and places the foot in a flatter position on the ground, forcing the plantar flexors to work harder and more forcefully. This puts additional strain on the Achilles tendon and is a likely factor in the many instances of Achilles tendon overuse injuries reported in the literature. It is possible that upon making the transition of using minimalist footwear, a sudden increase in related pain occurs before the body adapts and the pain subsequently decreases. Strength and conditioning professionals should remind their clients that a slow and steady transition strategy is likely the best route to take until the body is sufficiently adapted to the new demands.

FOREFOOT PRESSURE

Other research has looked into the possibility of force increases with minimalist footwear by examining forefoot pressure differences between minimalist and traditional footwear. One study found that minimalist footwear, regardless of foot strike, created greater peak and mean pressure across the forefoot region (1). Another study found greater peak pressures in the medial forefoot of minimalist runners participating in a 50-km race (7). This increase in pressure across the forefoot has been linked to reports of metatarsal stress fractures in runners using minimalist footwear. One case study featured a male marathon runner who experienced a metatarsal stress fracture upon transitioning to minimalist footwear (3). Additional reports of metatarsal stress fracture incidence in runners have been reported in other studies examining minimalist footwear runners (5,13).

Forefoot injury concerns may be some of the most pressing for new minimalist footwear users. Greater forces and pressures have been found across the forefoot region for minimalist runners, which could potentially lead to metatarsal stress fractures over time. Some arguments point to too short of a transition period and too quick of a return to normal mileage or activity. As with the other injury concerns previously detailed, these findings suggest

the need for a cautious approach by new users of minimalist footwear. Making the transition without reducing intensity or frequency of the activity may increase the risk of developing stress fractures in the foot.

LIMITATIONS

As the scope of literature on this subject is constantly increasing, it was impossible to attain information from every single research article published on this subject. The research presented here represents some of the more prominent findings, but is certainly not exhaustive. Additionally, it should be understood that much of the research presented considers minimalist footwear concerns from the perspective of runners, as they seem to be the largest user group of minimalist footwear. It is possible that this knowledge can be generalized to other sports, activities, and even casual wear, but this is not a given.

CONCLUSION

These numbers may appear to bode poorly for those in favor of using minimalist footwear, but they are neither definitive nor conclusive. It seems as if each study that demonstrates an increased risk of injury with minimalist footwear has another study that refutes it. The primary considerations for injury risk appear to include the period of time during which the transition occurs, how quickly the individual returns to the levels of activity achieved with traditional footwear, and whether or not foot strike patterns are altered during the transition. However, some of these considerations are highly individualized and may not necessarily lead to injury. Given this information, strength and conditioning professionals should make sure their clients know that a level of caution is highly advisable when it comes to using new minimalist footwear, especially when first starting. At the same time, it is important to point out that there are limitations to the current literature and that definitive evidence is still minimal.

REFERENCES

1. Bergstra, SA, Kluitenberg, B, Dekker, R, Bredeweg, SW, Postema, K, Van den Heuvel, ER, et al. Running with a minimalist shoe increases plantar pressure in the forefoot region of healthy female runners. *Journal of Science and Medicine in Sport* 18(4): 463-468, 2014.
2. Bonacci, J, Saunders, PU, Hicks, A, Rantalainen, T, Vicenzino, PT, and Spratford, W. Running in a minimalist and lightweight shoe is not the same as running barefoot: A biomechanical study. *British Journal of Sports Medicine* 47(6): 387-392 2013.
3. Cauthon, DJ, Langer, P, and Coniglione, TC. Minimalist shoe injuries: Three case reports. *The Foot* 23(2-3): 100-103, 2013.
4. Daoud, AI, Geissler, GJ, Wang, F, Saretsky, J, Daoud, YA, and Lieberman, DE. Foot strike and injury rates in endurance runners: A retrospective study. *Medicine and Science in Sports and Exercise* 44(7): 1325-1334, 2012.
5. Giuliani, J, Masini, B, Alitz, C, and Owens, BD. Barefoot-simulating footwear associated with metatarsal stress injury in 2 runners. *Orthopedics* 34(7): 320-323, 2011.
6. Hryvniak, D, Dicharry, J, and Wilder, R. Barefoot running survey: Evidence from the field. *Journal of Sport and Health Science* 3(2): 131-136, 2014.

TRADITIONAL VERSUS MINIMALIST FOOTWEAR—INJURY CONCERNS

7. Kasmer, ME, Ketchum, NC, and Liu, X-C. The effect of shoe type on gait in forefoot strike runners during a 50-km run. *Journal of Sport and Health Science* 3(2): 122-130, 2014.
8. Lieberman, DE, Davis, IS, and Nigg, BM. Introduction: The past, present, and future of research on running barefoot and in minimal shoes. *Journal of Sport and Health Science* 3(2): 65-66, 2014.
9. Miller, EE, Whitcome, KK, Lieberman, DE, Norton, HL, and Dyer, RE. The effect of minimal shoes on arch structure and intrinsic foot muscle strength. *Journal of Sport and Health Science* 3(2): 74-85, 2014.
10. Olin, ED, and Gutierrez, GM. EMG and tibial shock upon the first attempt at barefoot running. *Human Movement Science* 32(2): 343-352, 2013.
11. Perl, DP, Daoud, AI, and Lieberman, DE. Effects of footwear and strike type on running economy. *Medicine and Science in Sports and Exercise* 44(7): 1335-1343, 2012.
12. Rooney, BD, and Derrick, TR. Joint contact loading in forefoot and rearfoot strike patterns during running. *Journal of Biomechanics* 46(13): 2201-2206, 2013.
13. Salzler, MJ, Bluman, EM, Noonan, S, Chiodo, CP, and de Asla, RJ. Injuries observed in minimalist runners. *Foot and Ankle International* 33(4): 262-266, 2012.
14. Sinclair, J. Effects of barefoot and barefoot inspired footwear on knee and ankle loading during running. *Clinical Biomechanics* 29(4): 395-399, 2014.

ABOUT THE AUTHOR

Andy Chassé has been involved in the fitness field since 2007 and just completed his Master's degree in Kinesiology at the University of Texas-Pan American. For his Master's thesis, he investigated the general population's perceptions and preferences of personal trainers from a personality perspective. Chassé received his Bachelor's degree in Kinesiology in 2007 and holds multiple certifications through the National Academy of Sports Medicine (NASM) and the American College of Sports Medicine (ACSM).



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TENDINOPATHY AND A PREVENTATIVE MANAGEMENT STRATEGY FOR THE STRENGTH AND CONDITIONING PROFESSIONAL

KEITH CHITTENDEN, MS, CSCS,*D, TSAC-F,*D

Tendinopathy is a pathological condition that occurs when a tendon is repeatedly injured (i.e., a form of overuse injury) and degenerately breaks down. Tendinopathy begins with a condition known as tendinitis. When the tendon is constantly being used in an activity (occupational, recreational, or from poor position(s)), the result will be an inflamed tendon which requires rest and the cessation of the aggravating movement. Tendinitis is reversible initially and will not cause permanent damage if healing and rest is allowed to occur over time (1). If the tendon is not allowed to rest, the injury will likely reoccur. When this happens, the cellular structure of the tendon begins to break down. This results in degenerative changes that take place within the tendon. The final stage in tendinopathy can result in a full rupture of the tendon.

According to research, a tendon that is exposed to repetitive injury progresses through a pathological continuum (2). Due to the duration of the overuse action, this process can continue for up to a year or more. The first stage of the pathology is the injury. This is usually caused by a tensile force coupled with a loading force that creates damaging stress, either at a specific site or across the musculotendinous junction (1). During tendinitis, the tendon becomes inflamed, warm, tender to the touch, and swollen. This initial injury causes the primary inflammation and swelling to occur due to the overuse nature of the movement. The collagen and ground substance at the cellular level does not change. If treated with the RICE principle (rest, ice, compression, and elevation), the tendon can revert to its original status prior to injury.

The next stage is tendon disrepair. In this stage, the repetitive action is still affecting the tendon. The tendon has not finished the healing stage and is therefore exposed to more stress. The tendon in this weakened state will start to break down its collagen. The collagen and protein creates the cellular matrix of the tendon (1,2,5,6). Collagen is necessary for tendon repair. If excessive stress is placed on the tendon during the healing stage (when collagen is being laid down), the collagen will be compromised. The tendon will undergo chronic loading and increased proliferation of the ground substance. As a result, the tendon will thicken (2). Pain may or may not be present. However, the tendon will be more pronounced upon palpation. The thickening of the tendon can cause disruption at its attachment to the bone or the muscle belly as well.

The third stage is degenerative tendinopathy. In this final stage, the tendon's ground substance continues to break down and can cause cellular degradation and cell death. Once the cells in the collagen die, they cannot be replaced. Micro tearing of the tissues can occur as the ground substance breaks down. If the stress on the tendon is not removed, then the tendon will finally rupture (2). The person with tendinopathy can feel pain during concentric movements in which the tendon becomes shortened. There can also be a constant dull ache that can be felt even if the tendon is not being used. In the final stage of degeneration, it is difficult to return the tendon back to normal state before the initial injury. Two tendons that are commonly affected in degenerative tendinopathy are the Achilles tendon and the common extensor

tendon of the forearm, which causes tennis elbow (1,2). These two tendons are subjected to chronic and overload stresses during certain activities. Occupations such as typing, writing, or sustained walking may cause the overuse stress which contributes to the initial tendonitis—the first injury in the tendinopathy continuum.

Achilles tendinopathy occurs fairly equally in both females and males, frequently between the ages of 21 and 60, and is common in sports such as running and field sports (e.g., football, baseball, lacrosse, etc.). An occupation in which there is continuous walking and stair climbing may increase the likelihood of overuse of the Achilles tendon (9,11). Dysfunction in the lower kinetic chain can also play a role in tendinopathy of the Achilles (5,9). Tightness of the gastroc/soleus (posterior chain of lower leg) complex can increase strain on the tendon, and along with weakness of the anterior chain of lower leg resulting in the possible misalignment of the calcaneus. As a result, unaccustomed stresses are placed on the Achilles tendon due to the misalignment of the foot.

An anterior pelvic tilt and a tight iliotibial band can redistribute forces unevenly throughout the leg and into the foot (5). Misalignment of the lower leg can produce an overuse force and tightening in the Achilles tendon (9,11). In an altered alignment of the lower extremity, the biomechanics of the lower leg will be altered as well. These misalignments may increase the strain and load of the Achilles tendon and eventually change the collagen matrix in the ground substance (9). This changes the cellular properties of the tendon as well. As a result, the Achilles tendon can create the initial tendonitis and move the tendon down the pathological continuum.

Lateral epicondylitis (i.e., tennis elbow) is another common tendinopathy. The tendon most commonly involved with this tendinopathy is the extensor carpi radialis brevis (9). External stressors on the tendon include excessive typing, writing, hammering (or using a tight grip while manipulating tools or small objects), and sports using a tight grip (baseball, golf, tennis, squash, badminton, etc.) (9). Altered biomechanics of the upper extremity may result in tight muscles around the forearm extensors and flexors, triceps, biceps, and potential weakness in the scapular muscles. Due to the altered muscle length relationships with the surrounding muscles of the arm, the forearm extensor group will be exposed to the overload stress during activities involving the upper extremity (6,9).

It is important to recognize the signs and symptoms that the tendon is injured and needs to rest. In each stage in the tendinopathy continuum, the tendon undergoes physiological and histological (i.e., microscopic) changes. The client or athlete can experience pain and distortions in the tendon as it changes from one pathological stage to the next. Table 1 summarizes the signs and symptoms as the tendon goes through each stage in the pathological continuum.

For immediate treatment (i.e., initial stage tendinitis), the client should be referred to a medical professional. The medical professional may prescribe medication (such as NSAIDs), or refer that person to physical therapy for modalities such as ultrasound and stretching. For the strength and conditioning/health and fitness professional, specific exercise programming may help prevent the tendinitis from continuing into the pathological

tendinopathy continuum. Research has supported the use of eccentric exercises for tendinopathy. For most rehab professionals (e.g., physical therapists, athletic trainers, chiropractors, etc.) eccentric-based exercises have been the preferred choice for developing appropriate therapeutic exercise regimes. One advantage to using eccentric exercises over concentric exercises is the fact that it takes fewer muscle fibers to create a contraction. The muscle fibers are lengthened by gravity (decreasing internal effort force) and more tension is created in the contraction with less demand for energy and oxygen (1,4,6). The other advantage to using eccentric exercises over concentric exercises is the mechanical eccentric pull that occurs within the tissues has been shown to increase ion exchange and intracellular processes (4). The advantage to this is an increase in ion exchange at the cellular level (CA⁺, NA, K), which results in more collagen production in the ground substance (1,2).

According to research, eccentric training can result in decreased tendon volume, decreased intratendinous signal on a magnetic resonance imaging (MRI) test, and a reduction in fluid content within the tendon (which may increase collagen deposition thereby improving functional performance of the tendon) (1,4). Davenport et al. showed a high rate of return to pre-morbid activities in athletes from Achilles tendinopathy after eccentric exercise training (3). Eccentric loading eliminated focal thickening of the affected Achilles tendon. Sussmilch-Leitch et al. showed that a 12-week eccentric strength program demonstrated the best results in the reduction and prevention of tendinopathies (12).

MANAGEMENT AND PREVENTION OF TENDINOPATHY

STRETCHING

Research has supported stretching of the involved muscles for lateral epicondylitis and Achilles tendinitis. The preferred time to stretch is when the tendon is not as reactive, such as during the acute stages of the injury (24 – 72 hr) (1,7). Research has supported the use of PNF (proprioceptive neuromuscular facilitation) stretching, also known as contract and relax. PNF stretching may be used with a partner or when alone. In this form of stretching, the involved muscle (the agonist) is taken to its range of motion limit. When the barrier is felt (i.e., the point in which the extremity cannot be passed any further into the range of motion), an isometric hold of 6 seconds is performed (either against a partner or against yourself using the other extremity to create a blocking force) (1). The isometric contraction should be between 20 – 50% of maximum effort to avoid injury of the restricted muscle. The muscle should relax to a greater extent than it was initially, and it can then be brought into a new end-range. This process may be repeated 3 – 5 times to maximize the results.

In the case of lateral epicondylitis, the wrist should be stretched into its available range of wrist flexion (i.e., pulling the palm down) while the elbow is maintained in full extension. When a barrier is felt, then the isometric hold should be executed against a resistance (against a partner's force or given by yourself using the opposite extremity) into wrist extension in order to relax the wrist extensors (especially the extensor carpi radialis brevis). This will activate the Golgi tendon organ (GTO) within the muscle belly of the extensor muscles. The GTO protects the muscle from an overload of tension. When activated, the GTO sends a signal to the motor unit via a spinal cord reflex arch, which signals the muscle

TENDINOPATHY AND A PREVENTATIVE MANAGEMENT STRATEGY FOR THE STRENGTH AND CONDITIONING PROFESSIONAL

to relax. The same principle can be used in the Achilles tendon.

CLIENT EDUCATION

One of the most important tasks that many health and fitness professionals overlook is education. An effective way to prevent overuse injuries and tendinopathies from occurring is to educate clientele on the subject. Recognizing the signs of overuse or overtraining is important and is an expected responsibility of every health and fitness professional. Teaching the client how to recognize adverse stresses/forces, how to properly unload and reload forces, and how to prevent future overuse injuries is an effective approach. In clinical research, this approach is known as the EDUREP model (3).

This model is often used in a healthcare setting (i.e., physical therapy and chiropractic care) and is used to prevent long-term functional limitations and disability among patients with tendinopathy. There are four steps to this model.

The first step is to *EDucate* the client on tendinopathy. This includes the etiology, the symptoms, and the stresses (forces) that are causing the injury.

The next step is to *Unload* the stresses/forces on the tendon. This may take the most time and effort as it could be an occupational stress that may need to be altered to reduce injury of the tendon (i.e., reduction of walking/standing, frequent breaks from activity contributing to the injury, frequent icing of the tendon, etc.) (3).

The next step is to *REload* the tissue. This step includes the addition of stretches and exercises summarized in this article to reverse the stresses on the overloaded tendon that is being injured. The health and fitness/strength and conditioning professional can contribute to preventing tendinopathy at this stage.

The final step is *Prevention* of the injury. Prevention of the reoccurrence of a newly healed tendinopathy is an important step that needs to be integrated into the client's program. This will include awareness of any future signs and symptoms of tendinitis. This will also help the health and fitness professional add variety to the training program to avoid another episode of tendinopathy. The goal of implementing the EDUREP model is to change physical behaviors of clients and prevent injuries from occurring initially as well as chronic recurrences (3).

EXERCISES

Eccentric exercises have been shown to be the most productive against preventing tendinopathies in tendons subjected to overuse stress (4,6,10). Decreasing the stress on the tendon that is affected is important. It is also important to strengthen the fibers of the muscles in a lengthened position as well as in the shortened position (7). In athletic competitions, eccentric contractions are important to produce power and maximal force in a dynamic manner. These exercises may be performed for all athletic clients or clients that have had a history of tendinopathy. It is also important to include exercises for the muscles around the area of the tendinopathy. These muscles may be weak and not supporting the tendon that is being overused. Through proper strengthening

of these muscles, the muscle imbalance of the area of overuse should be resolved in the short term. Table 2 provides a summary of exercises for both Achilles and common forearm extensor and flexor muscle group tendinopathies.

EXERCISES FOR THE ACHILLES

ECCENTRIC CALF RAISE (FIGURES 1A AND 1B)

Start on a box or a six-inch step and place the toes and midfoot on the step. The heels of both feet should be off the step. To start the exercise, raise the heels up, then slowly control the descent down past the start point until a full lengthening of the gastrocnemius is felt. All active range of motion (ROM) should be taken up at the end of the exercise. The ankles should be in full passive dorsiflexion. Repeat for three sets of 10 repetitions each.

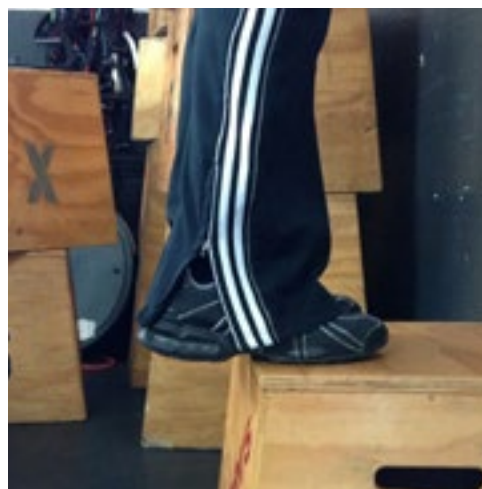


FIGURE 1A. ECCENTRIC CALF RAISE



FIGURE 1B. ECCENTRIC CALF RAISE

ECCENTRIC SINGLE-LEG CALF RAISE (FIGURES 2A AND 2B)

Similar to the two-leg calf raise, position the feet so that the heels are off the box or step. In the starting position, use two feet to go up on the toes. When the maximum height from the step or box is reached, take one foot away (i.e., flex at the knee) and slowly control the descent into passive dorsiflexion until full ROM is reached. Switch feet and do the same with the other foot. Repeat for three sets of 10 repetitions each.



FIGURE 2A. ECCENTRIC SINGLE-LEG CALF RAISE



FIGURE 2B. ECCENTRIC SINGLE-LEG CALF RAISE

RESISTED ANKLE DORSIFLEXION-TIBIALIS ANTERIOR (FIGURE 3)

Lie or sit on a table or chair with the foot out in front and toes pointed up at the ceiling. Wrap a band or resistance band around the dorsum of the foot with the pull of resistance towards the plantar surface of the foot. Keeping the knee straight, pull the foot up towards the head and hold for 1 – 2 s. Release the tension slowly to allow a full and controlled eccentric contraction until the foot returns to the starting position. After performing on one side, switch feet and do the same with the other foot. Repeat for three sets of 10 repetitions each.

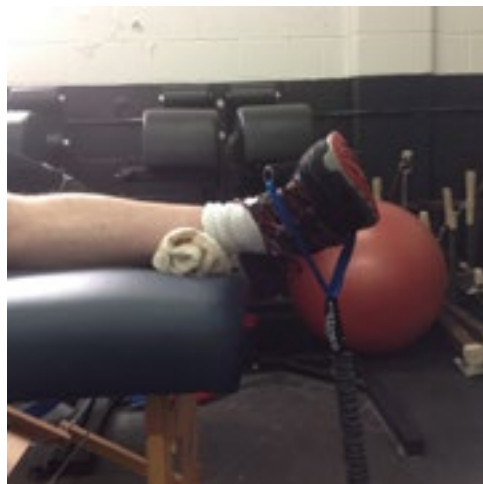


FIGURE 3. RESISTED ANKLE DORSIFLEXION-TIBIALIS ANTERIOR

RESISTED ANKLE INVERSION-TIBIALIS POSTERIOR (FIGURE 4)

Lie sideways on a table with the medial side of the exercising foot facing the ceiling. Wrap the band around the foot so that the resistance is pointing down through the lateral side of the foot. Keeping the knee slightly flexed and resting on the table, bring the medial side and medial sole of the foot up towards the ceiling against the resistance. Hold the position for 1 – 2 s, then slowly release the foot with control back to the starting position. Switch feet and do the same with the other foot. Repeat for three sets of 10 repetitions each.

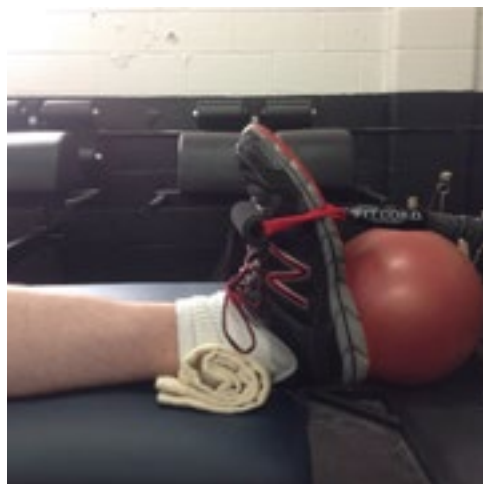


FIGURE 4. RESISTED ANKLE INVERSION-TIBIALIS POSTERIOR

EXERCISES FOR THE ELBOW

ECENTRIC WRIST EXTENSION-EXTENSOR GROUP (FIGURES 5A AND 5B)

Sit at a table with the exercising forearm resting on the table and with the wrist and hand in a palm down position while holding a dumbbell that is positioned off the table. Using the other hand (i.e., non-exercising hand), grab the hand with the dumbbell and manually raise the wrist into full extension. Slowly allow the wrist to move toward the floor into passive wrist flexion (the intent is to resist the effects of gravity pulling the wrist into wrist flexion). Attempt to slow the motion down as the wrist moves into wrist flexion. To aid in determining the proper speed of the contraction, the client should count from six to one to get the effective benefit of using an eccentric contraction of extensor muscles in this exercise. Switch arms and do the same with the other wrist. Repeat for three sets of 10 repetitions each.

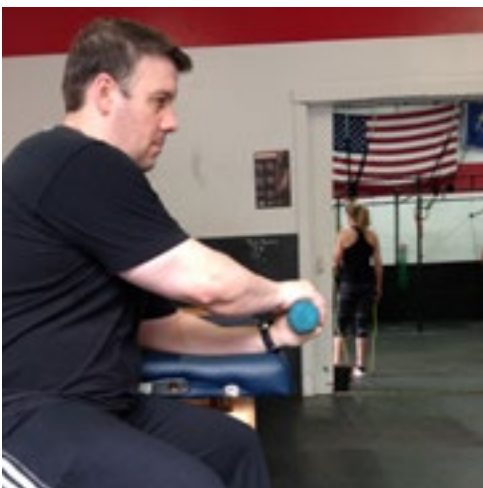


FIGURE 5A. ECENTRIC WRIST EXTENSION-EXTENSOR GROUP

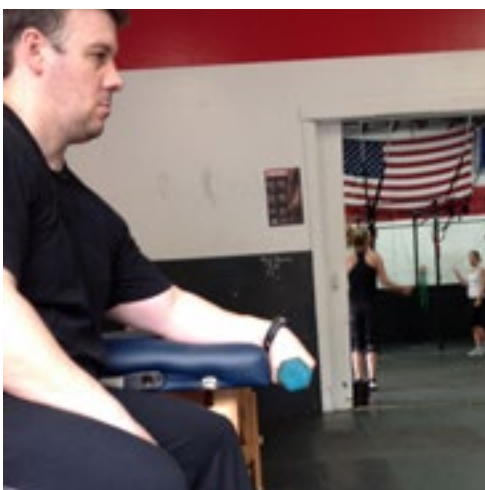


FIGURE 5B. ECENTRIC WRIST EXTENSION-EXTENSOR GROUP

ECENTRIC WRIST FLEXION-FLEXOR GROUP (FIGURES 6A AND 6B)

Sit at a table with the exercising forearm resting on the table and with the wrist and hand in a palm up position while holding a dumbbell that is positioned off the table. Using the other hand (non-exercising hand), grab the hand with the dumbbell and manually raise the wrist into full wrist flexion. Slowly allow the wrist to move into passive wrist extension while executing an eccentric contraction against gravity. The client can use the same six-second backwards count to maximize the eccentric contraction of the wrist flexors during the exercise. Switch arms and do the same with the other wrist. Repeat for three sets of 10 repetitions each.

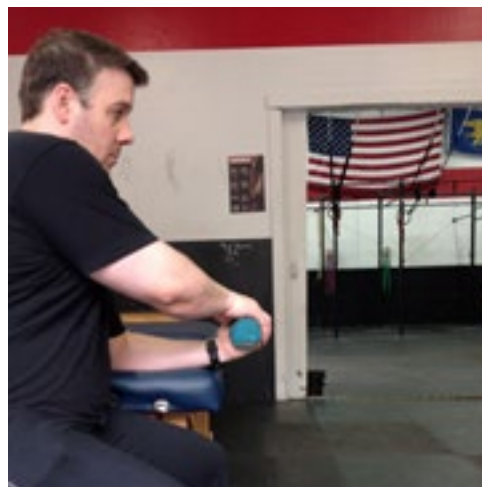


FIGURE 6A. ECENTRIC WRIST FLEXION-FLEXOR GROUP

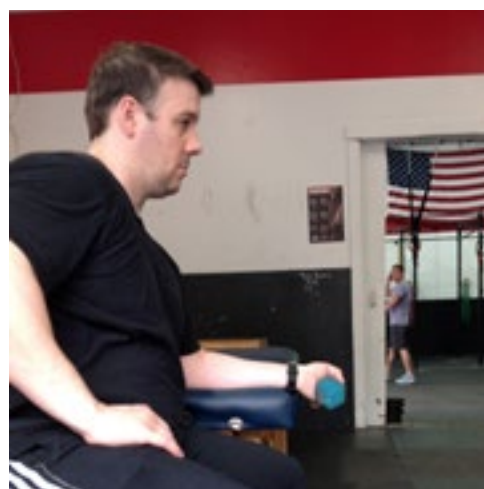
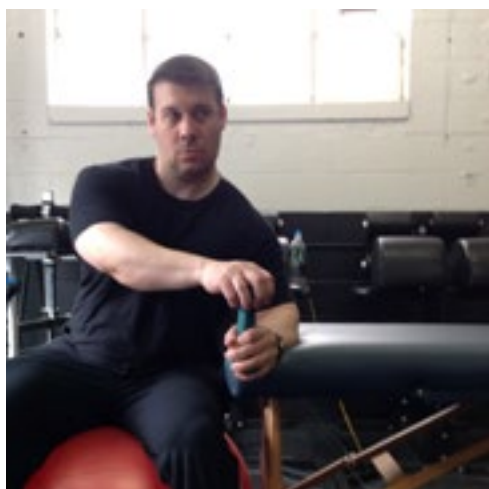
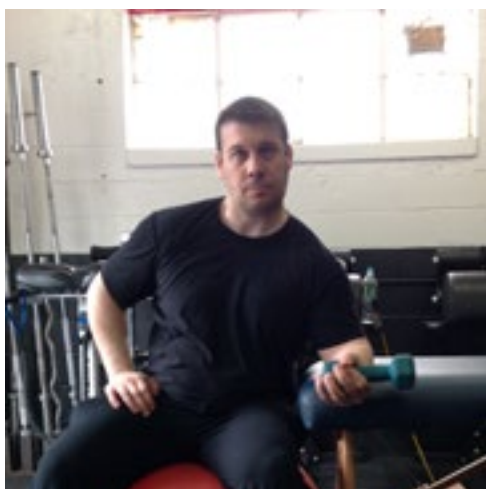


FIGURE 6B. ECENTRIC WRIST FLEXION-FLEXOR GROUP

RESISTED SUPINATION AND PRONATION (FIGURES 7A AND 7B)

Sit at a table and rest the exercising arm on the table. Using a light dumbbell (e.g., 5 – 8 lb), grip the dumbbell by grasping the end of it with the hand of the exercising arm. Start with the involved palm facing up by using the forearm muscles (pronators) to slowly rotate the forearm holding the dumbbell until the palm is facing down towards the floor (i.e., rotate 180 degrees or as far as possible). Keep the elbow and upper arm as steady as possible and do not allow the arm to slide back and forth on the table. Hold the contraction for 1 – 2 s and slowly return to the starting position to take advantage of the eccentric contraction of the pronators. The exercise can also be started in pronation (palm facing down). Simply reverse the motion by rotating the forearm to the up position (i.e., supination). Slowly return the arm to the starting position using an eccentric contraction of the supinator muscles. Switch arms and do the same with the other wrist. Repeat for three sets of 10 repetitions each.

**FIGURE 7A. RESISTED SUPINATION AND PRONATION****FIGURE 7B. RESISTED SUPINATION AND PRONATION****REFERENCES**

1. Andres, BM, and Murrel, GC. Treatment of tendinopathy: What works, what does not, and what is on the horizon. *Clinical Orthopaedics and Related Research* 466(7): 1539-1554, 2008.
2. Cook, JL, and Purdam, CR. Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. *British Journal of Sports Medicine* 43: 409-416, 2009.
3. Davenport, TE, Kulig, K, Matharu, Y, and Blanco, CE. The EDUREP model for nonsurgical management of tendinopathy. *Physical Therapy* 85: 1093-1103, 2005.
4. Kerksick, CM, and Kravitz L. How to incorporate eccentric training into a resistance training program. *Strength and Conditioning Journal* 37(1): 5-17, 2015.
5. Khamis, S, and Yizhar, Z. Effect of feet hyperpronation on pelvic alignment in a standing position. *Gait Posture* 25: 127-134, 2007.
6. Lorenz, D. Eccentric exercise interventions for tendinopathies. *Strength and Conditioning Journal* 32(2): 90-98, 2010.
7. Park, YJ, Park, HK, Choi, JH, and Moon, ES. Prospective evaluation of the effectiveness of a home-based program of isometric strengthening exercises: 12-month follow-up. *Clinical Orthopedic Surgery* 2: 173-178, 2010.
8. Saglimbeni, AJ, and Fulmer, CJ. Achilles tendon injuries differential diagnoses. Retrieved April 2015 from <http://emedicine.medscape.com/article/309393-differential>.
9. Silvestrini-Martinez, J. Chronic lateral epicondylitis: Comparative effectiveness of a home exercise program including stretching alone versus stretching supplemented with eccentric of concentric strengthening. *Journal of Hand Therapy* 18: 411-420, 2005.
10. Small, K, McNaughton, L, Greig, M, and Lovell, R. Effect of timing of eccentric hamstring strengthening exercises during soccer training: Implications for muscle fatigability. *The Journal of Strength and Conditioning Research* 23(4): 1077-1083, 2009.
11. Sorosky, B, Press, J, Plastaras, C, and Rittenberg, J. The practical management of Achilles tendinopathy. *Clinical Journal of Sports Medicine* 14: 40-44, 2004.
12. Sussmilch-Leitch, SP, Collins, NJ, Bialocerikowski, AE, Warden, SJ, and Crossley, KM. Physical therapies for Achilles tendinopathy: Systematic review and meta-analysis. *Journal of Foot and Ankle Research* 5(15): 1-16, 2012.
13. Yu, J, Park, D, and Lee, G. Effect of eccentric strengthening on pain, muscle strength, endurance, and functional fitness factors in male patients with Achilles tendinopathy. *American Journal of Physical Medicine and Rehabilitation* 92(1): 68-76, 2013.

ABOUT THE AUTHOR

Keith Chittenden is a Certified Strength and Conditioning Specialist® with Distinction (CSCS,*D®) and Tactical Strength and Conditioning Facilitator® with Distinction (TSAC-F,*D®) through the National Strength and Conditioning Association (NSCA). He is also a fitness trainer and holds a Master's degree in Exercise Science from California University of Pennsylvania. He was a columnist for the NSCA's TSAC Report and continues to be a regular contributor

to the NSCA Associate Publications, as well as popular fitness websites. Chittenden has over 13 years working with athletes, police officers, and military personal in areas such as fitness, performance enhancement, and post-rehabilitation.

TABLE 1. TENDINOPATHY AND ITS IMPACT ON STRENGTH TRAINING (1,4,6)

STAGE IN PATHOLOGICAL CONTINUUM	PAIN/DISCOMFORT FELT	VISIBLE SIGNS	RECOMMENDED TREATMENT/ACTIVITY
Stage 0: Normal	none	none	Strengthening muscles surrounding the tendons subject to injury
Stage 1: Initial tendinitis	Acute pain and discomfort centered around a specific point on the tendon. Tendon is still strong but painful during active range of motion. Warm to the touch.	Possible visible swelling	24 hours – 8 days: ice, rest, stretching muscles that are tight around the tendon
Stage 2: Tendon disrepair	Chronic re-injury of original tendinitis. Painful upon active range of motion. Pain may be felt both at the point of the tendinitis and distal to the area of original injury. Often dysfunction of affected extremity is present.	Tendon enlarged; may be visible. Easy to palpate tendon. May be tender to palpate.	Eccentric exercises on affected tendons, removal of stress on the tendon, and strengthening of surrounding muscles around the affected tendon
Stage 3: Degenerative tendinopathy	Pain on palpation, chronic degeneration of tendon, and weak and painful upon active range of motion.	Tendon enlarged, and dysfunction of involved extremity; may affect occupation and daily activities.	Eccentric exercises, stretching of affected tendon, and strengthening of surrounding muscles to balance load and stress over multiple muscles and tendons
Stage 4: Rupture	No pain on palpation, weak and painless on active range of motion.	A lump may be present from the rupture of the tendon.	Medical/surgical professional for repair/reattachment of tendon

TABLE 2. SUMMARY OF EXERCISES FOR BOTH ACHILLES TENDINOPATHY AND COMMON EXTENSOR TENDINOPATHY

TENDON/MUSCLE	EXERCISE	RESISTANCE	SETS	REPS
Achilles tendon	Eccentric calf raise (both feet)	Bodyweight	3	10
Achilles tendon	Eccentric single calf raise (one foot)	Bodyweight	3	10
Achilles tendon	Resisted dorsiflexion	Theraband/exercise band (5 – 10 lb)	3	10
Achilles tendon	Resisted inversion	Theraband/exercise band (5 – 10 lb)	3	10
Common extensor tendon	Eccentric extension	Dumbbell (5 – 8 lb)	3	10
Common flexor tendon	Eccentric flexion	Dumbbell (5 – 8 lb)	3	10
Supinator	Forearm roll/supination	Dumbbell (5 – 10 lb)	3	10
Pronator	Forearm roll/pronation	Dumbbell (5 – 10 lb)	3	10



HOW THE MEMBER EXPERIENCE IMPACTS YOUR BOTTOM LINE

JOSH LEVE

Recently I was speaking to a family friend about the explosion of fitness studios in the local area. He mentioned that he was amazed to see so many opening and even recounted his recent experience with one. Here is what happened...

While out grocery shopping, he noticed some clever advertising in the window of a local fitness studio. He was interested because he and his wife are involved with Pilates, yoga, and personal training. He thought he would grab some information, check out the space and determine if the studio was a good fit for what they were looking for. However, it is when he walked in the door that everything changed.

First, there was no one there to greet him. Not only that, the owner was conducting a group class. My friend asked for some information related to the studio to review (already feeling weird about it because he was the one interrupting class). The owner promptly replied, "We're out, and need to make more copies, sorry."

"Ok, not a problem," he said. "Is there anyone I could talk to—to learn more about the studio?" The owner replied, "That would be me and I'm in the middle of class—come back in 30 minutes."

He walked out, and never came back.

Unfortunately, for small business owners, especially fitness businesses, this is an all too common occurrence and can ultimately affect a facility's bottom line.

Trust me, I get it. I understand you're strapped for time as a small business owner, juggling all aspects of your business, including training. However, in today's competitive environment you must switch your mindset to that of your customer. You must create an experience so positive that a prospect wants to join. Remember, many times the person who walked in your door might already be apprehensive about working out. It is your job to make them feel comfortable, you are the expert—take the guesswork out of the hands of prospective clients.

As a studio operator, let's be honest, you love to train your clients, but don't let the most basic fundamental elements of business get brushed aside. Your business is a reflection on you. And the experience your prospects and your clients receive begins the moment they walk in your door.

For example...

- How are they greeted? With a welcoming smile or with someone on their cell phone? Members (and/or clients) are like teeth—ignore them, and they will go away; or take good care of them, and they will stay forever. Okay, maybe not necessarily forever, but you get the drift.
- If they are a client or member are they greeted by name? If not, they should be if possible. Recently, a friend of mine had a medical test done and the nurse kept calling him "buddy." How difficult would it have been for her to look on the chart and find out his real name? This all relates back to the concept of creating a positive experience.
- What information is available for prospects? At the very least you should have fliers with contact information, details about your business, your classes, and your core values. Business cards are great informational tools. But are they available? One option to distribute business cards is to staple them to your fliers.
- Do the little things. Send clients a birthday greeting—an actual card via the US Postal Service—not email. It will be a nice surprise and very well received by your client.
- Sign-up sheets and specialty fliers for classes. It is all about lead capture, so make sure you are set up properly for them to sign up.

It is no wonder fitness studios are exploding in popularity across the country—that personalized, you can feel at home here, everybody knows your name approach is inviting and welcoming. You feel more connected to your environment in this approach.

At times, it is imperative that you take a look at your business from the outside. Remember, your frontline staff is the lifeline of your business. Keeping them motivated and engaged is crucial in ensuring your business has a great first impression. So how do you keep them happy?

1. This seems so simple, and yet easy to miss. When you hire your frontline staff, it is important for them to understand your business and culture, and want to be involved in your forward growth. If they are not fitness people, it is probably not a good fit.
2. Make sure to congratulate your employees when they have done great job. It is the little things, such as wowing a member, or stepping up to the plate when an instructor needs assistance that shows they care. Make sure to let them know you acknowledge this.
3. Too many times employees wind up making decisions because they do not remember the proper protocol. Going over the basics from time to time is not only going to ensure your staff knows what to do, it is going to help them be confident in their decision making.
4. Anything you have your staff do, make sure to follow suit and do the same (lead by example).

By laying the groundwork for a strong community within your facility's staff, and developing this community with regularity, your employees will have a greater impact on the lives of your members and, therefore, a greater impact on your bottom line.

At the end of the day, remember one thing: it is all about the member/client experience. Know what your competitors are doing and then blow them out of the water by doing it better. Make your members and prospects feel great and they will tell their friends. It all starts from the moment they walk in your door. Provide your clients with the best member experience and they will stay and continue to pay.

ABOUT THE AUTHOR

As Co-Founder and President of the Association of Fitness Studios (AFS), Josh Leve is responsible for strategic business operations of AFS. Leve has over 10 years of sales, consulting, advertising, marketing, operations, and retail fitness experience. Prior to AFS, Leve successfully turned around the financial performance of three different big box facilities in Chicago while providing consultative services for smaller fitness studios. Prior to his health club experience, Leve worked with Corbett Accel—the largest healthcare communications/advertising company in the United States—where he launched products for major pharmaceutical companies such as Merck, Bristol Myers Squibb, and Sanofi-Aventis. Leve holds a Bachelor of Arts degree in Journalism from the University of Kansas.



THE STRENGTH AND CONDITIONING PROFESSIONAL'S ROLE IN PREVENTING FALLS OF OLDER ADULTS

JEFFREY ALEXANDER, PHD, FAACVPR

Every year, one out of three older adults (65 years of age and older) experiences a fall (4). These falls often lead to injury and possibly even preventable death. In 2012 and 2013 there were almost 60,000 deaths in the United States as a result from a fall in older adults (4). Additionally, there are several other negative short- and long-term effects which can result from falling, such as disability, reduced quality of life, loss of independence, increased healthcare costs, and fear of doing daily activities. While a multidisciplinary approach to fall prevention among the growing older adult population is ideal, the cost to implement and sustain such a plan is prohibitive. Exercise, as a single component of a fall prevention strategy, has been shown to reduce the occurrence of falls in community-dwelling older adults (7). Consequently, certified strength and conditioning professionals have the opportunity to play an important role in preventing and reducing the severity of falls among older adults in the community. The purpose of this article is to review common risk factors for falls, discuss practical means to assess risks, and propose training strategies and other avenues aimed at reducing the risk of falling in older adults.

RISK FACTORS FOR FALLS

Several factors have been identified, which heighten the risk of falls among older adults. These factors can be divided into non-modifiable and modifiable risks. Strength and conditioning professionals should be aware of both risk factor types in order to identify those at risk and to develop an effective approach for addressing risks that can be altered through physical training.

While the list of non-modifiable and modifiable risk factors below is not exhaustive, it should provide strength and conditioning professionals with an awareness of several important factors that may help in identifying and treating those at heightened risk.

NON-MODIFIABLE RISK FACTORS

Age: Risk for falls increases in older adults with advancing age (8). Yet, this increased risk with age may be more related to a decline in health and physical function rather than an increase in years (8).

Sex: According to a study in the United States, fall injuries among older adults are greater in women than men (19). In contrast, however, fall fatality rates appear to be greater for men than for women (20). Furthermore, fall risk in those 85 years of age and older has been found to be greater among men than women (8). Consequently, when assessing fall risk based on sex, one must consider the interaction between age and sex.

History of Falls: Older adults with a history of falls are at heightened risk of falling again (1,5,16).

MODIFIABLE RISK FACTORS

Muscular Strength and Power: Muscular weakness, especially in the lower extremities, is an important risk factor for falls among older adults (14). While further research is warranted, reduced muscular power appears to increase the risk of falling in older adults (9,11).

Balance: Research related to falls and balance demonstrates the positive correlation between balance deficits and fall risk in older adults (1).

Flexibility: Adequate flexibility or mobility in the lower extremities, especially at the hip and ankle joints, is important for reducing fall risk in older adults (6,12).

ASSESSMENT OF MODIFIABLE RISK FACTORS

All older adults should be assessed for fall risk either in combination with or independent of other essential physical and psychosocial assessments. Assessing non-modifiable risk factors can be as simple as asking the client a few questions. However, assessing modifiable risk factors requires more time and involvement from both the client and the strength and conditioning professional.

In most cases, there are several valid assessment tools for each of the modifiable risk factors; however, for the purposes of this article, only one or two for each will be described. Strength and conditioning professionals should use good judgement and caution with any assessment activity to ensure safety.

ASSESSING MUSCULAR STRENGTH

Strength should be measured, in particular, for the lower extremities. The most common method for assessing muscular strength is the one-repetition maximum (1RM). However, for this population, 1RM measurement is not often feasible. If this is the case, then the 5RM or the 30-s chair stand test may be used as appropriate alternative measures (2,3).

BALANCE ASSESSMENT

Several balance assessment tools are available to the strength and conditioning professional, such as the Berg Balance Scale (BBS). The BBS is a 14-item balance measure and may be a viable option because it is easy to administer and inexpensive (18). In a recent study, research determined that the BBS was a valid predictor of fall risk (17). As with any balance assessment, strength and conditioning professionals should use caution and good judgement to determine what individual clients can and cannot do. They should also provide support and assistance during the test, as needed, to prevent a client from falling.

FLEXIBILITY ASSESSMENT

Flexibility and mobility of the hip joint and the foot-ankle complex should be assessed. There are various means to assess flexibility including the sit-and-reach test (10). Fitness professionals are encouraged to use methods they are comfortable with to assess flexibility of their older clients to help determine their risk of falling.

TRAINING STRATEGIES TO REDUCE FALL RISK

Training strategies to reduce the risk of falling among older adults must be directly tailored to findings from an individual's fall risk assessment. Therefore, in reviewing the training recommendations below, strength and conditioning professionals should use the individual's weaknesses and specific risks (based on their assessment) to guide professional application. While a general strength and conditioning program that includes a foundation of aerobic, strength, and flexibility training is recommended, it is essential to integrate training strategies that are specific to fall prevention as well.

STRENGTH AND POWER TRAINING

Strength and conditioning professionals should focus on strength and power training. Specifically, attention should be paid to the muscles required for flexion and extension of the hip and knee joints and plantar flexion and dorsiflexion of the ankle joints (11,13,21,22).

BALANCE TRAINING

Both static and dynamic balance training should play an integral role in exercise programming for fall prevention. Balance training can be completed in isolation or integrated with strength and power training. For example, depending on ability level and comfort, heel raises can be performed in a single-leg stance, narrow two-leg stance, wide two-leg stance, on a step, or on an instability balance trainer.

FLEXIBILITY TRAINING

Increasing flexibility and mobility, primarily in the hips, knees, and ankles, is essential for fall prevention. Both static and dynamic flexibility training methods can be incorporated into training programs for older adults. When designing a fall prevention exercise program using the training modalities described above, strength and conditioning professionals should incorporate functional movements as much as possible. For example, tasks similar to everyday life such as stepping over and maneuvering around obstacles can be used to improve balance and flexibility. Another example that may aid with strength and balance development is to incorporate squatting to lift an everyday object of a known weight (such as a one gallon water container, roughly eight pounds) and placing it on a shelf at eye level. Strength and conditioning professionals should be creative and work with the older adults to determine trouble areas (e.g., fear of falling when reaching to pick up objects from the floor) to help guide the programming.

INTERPROFESSIONAL COLLABORATION

Falls among older adults are a multifaceted public health concern; therefore, professionals from a variety of disciplines should work collaboratively to alleviate the issue. When necessary, fall prevention strategies should involve strength and conditioning professionals, primary care providers, physical therapists, audiologists, optometrists, social workers, occupational therapists, dietitians, and community health workers, among other professionals. Strength and conditioning professionals should reach out to other professionals to provide the most comprehensive approach to reducing their clients' risk of falling if it is outside of their scope of practice.

Furthermore, strength and conditioning professionals should embrace community efforts already in place by being actively engaged in local fall prevention coalitions and networks. A list of coalitions in the United States is provided by the National Council on Aging (15). Active engagement with community efforts through coalitions will not only enhance strength and conditioning professionals' ability to make a difference in the community, but also expand their network with like-minded professionals, which could result in the growth of their client pool. Interprofessional collaboration may also be achieved through involvement with evidence-based, community fall prevention programs. A list of the aforementioned programs is provided by the National Council on Aging (15). In addition, a compendium has been developed by the Centers for Disease Control and Prevention (4).

THE STRENGTH AND CONDITIONING PROFESSIONAL'S ROLE IN PREVENTING FALLS OF OLDER ADULTS

CONCLUSION

Falls among older adults are a serious public health concern. Certified strength and conditioning professionals can play an integral part in the effort to reduce falls, as well as the cascade of associated problems after a fall, such as disability, reduced quality of life, loss of independence, increased healthcare costs, fear, and death. By utilizing muscular strength, balance, and flexibility assessments, strength and conditioning professionals can effectively design specific training programs for older adults. Adhering to an individualized, well-designed exercise program can be an effective strategy for reducing the risk of falling in older adults.

REFERENCES

1. Ambrose, AF, Paul, G, and Hausdorff, JM. Risk factors for falls among older adults: A review of the literature. *Maturitas* 75(1): 51-61, 2013.
2. Benton, MJ, and Alexander, JL. Validation of functional fitness tests as surrogates for strength measurement in frail, older adults with chronic obstructive pulmonary disease. *American Journal of Physical Medicine and Rehabilitation* 88(7): 579-583, 2009.
3. Brzycki, M. Strength testing – predicting a one-rep max from reps to fatigue. *JOPERD* 68: 88-90, 1993.
4. Center for Disease Control and Prevention. Important facts about falls. Home and Recreational Safety. September 2015. Retrieved 2015 from <http://www.cdc.gov/homeandrecreationsafety/falls/adultfalls.html>.
5. Deandrea, S, Lucenteforte, E, Bravi, F, Foschi, R, La Vecchia, C, and Negri, E. Risk factors for falls in community-dwelling older people: A systematic review and meta-analysis. *Epidemiology* 21(5): 658-668, 2010.
6. Emilio, EJML, Hita-Contreras, F, Jiménez-Lara, PM, Latorre-Román, P, and Martínez-Amat, A. The association of flexibility, balance, and lumbar strength with balance ability: Risk of falls in older adults. *Journal of Sports Science and Medicine* 13(2): 349-357, 2014.
7. Franco, MR, Pereira, LS, and Ferreira, PH. Exercise interventions for preventing falls in older people living in the community. *British Journal of Sports Medicine* 48: 867-868, 2014.
8. Grundstrom, AC, Guse, CE, and Layde, PM. Risk factors for falls and fall-related injuries in adults 85 years of age and older. *Archives of Gerontology and Geriatrics* 54(3): 421-428, 2012.
9. Han, L, and Yang, F. Strength or power, which is more important to prevent slip-related falls? *Human Movement Science* 44: 192-200, 2015.
10. Jones, CJ, Rikli, RE, Max, J, and Noffal, G. The reliability and validity of a chair sit-and-reach test as a measure of hamstring flexibility in older adults. *Research Quarterly for Exercise and Sport* 69(4): 338-343, 2013.
11. LaRoche, DP, Cremin, KA, Greenleaf, B, and Croce, RV. Rapid torque development in older female fallers and nonfallers: A comparison across lower-extremity muscles. *Journal of Electromyography and Kinesiology* 20(3): 482-488, 2010.
12. Menz, HB, Morris, ME, and Lord, SR. Foot and ankle characteristics associated with impaired balance and functional ability in older people. *The Journals of Gerontology Series A, Biological Sciences and Medical Sciences* 60(12): 1546-1552, 2005.
13. Morcelli, MH, Crozara, LF, Rossi, DM, LaRoche, DP, Ribeiro Marques, N, Hallal, CZ, et al. Hip muscles strength and activation in older fallers and non-fallers. *Isokinetics and Exercise Science* 22(3): 191-196, 2014.
14. Moreland, J, Richardson, J, Goldsmith, C, and Clase, C. Muscle weakness and falls in older adults: A systematic review and meta-analysis. *Journal of the American Geriatrics Society* 52(7): 1121-1129, 2004.
15. National Council on Aging. Retrieved November 2015 from www.ncoa.org.
16. Panel on Prevention of Falls in Older Persons, American Geriatrics Society, and British Geriatrics Society. Summary of the Updated American Geriatrics Society/British Geriatrics Society Clinical Practice Guideline for Prevention of Falls in Older Persons. *Journal of the American Geriatrics Society* 59: 148-157, 2011.
17. Pereira, VV, Maia, RA, and de Azevedo Silva, SMC. The functional assessment Berg Balance Scale is better capable of estimating fall risk in the elderly than the posturographic Balance Stability System. *Arquivos de Neuro-Psiquiatria* 71(1): 5-10, 2013.
18. Rehabilitation Institute of Chicago, Center for Rehabilitation Outcomes Research, and Northwestern University Feinberg School of Medicine Department of Medical Social Sciences Informatics. Rehabilitation measures database – Berg balance scale. 2010. Retrieved 2015 from <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=888>.
19. Stevens, JA, Corso, PS, Finkelstein, EA, and Miller, TR. The costs of fatal and non-fatal falls among older adults. *Injury Prevention* 12(5): 290-295, 2006.
20. Stevens, JA, and Sogolow, ED. Gender differences for non-fatal unintentional fall related injuries among older adults. *Injury Prevention* 11(2): 115-119, 2005.
21. Studenski, S, Duncan, PW, and Chandler, J. Postural responses and effector factors in persons with unexplained falls: Results and methodologic issues. *Journal of the American Geriatrics Society* 39(3): 229-234, 1991.
22. Whipple, RH, Wolfson, LI, and Amerman, PM. The relationship of knee and ankle weakness to falls in nursing home residents: an isokinetic study. *Journal of the American Geriatrics Society* 35(1): 13-20, 1987.

ABOUT THE AUTHOR

Jeffrey Alexander is an Associate Professor in the Doctor of Health Sciences Program at A.T. Still University. He completed his Bachelor's and Master's degrees in Health Promotion and Exercise Physiology, respectively, at Brigham Young University and his PhD in Curriculum and Instruction with an emphasis in Exercise and Wellness at Arizona State University. Alexander's research interests center on improving the health and wellbeing of older adults. He serves as the Chair of the Mesa Campus Advisory Committee for A.T. Still University's Aging Studies Project. Alexander serves on the steering committee of the Arizona Fall Prevention Coalition and is the Chair of the Coalition's Evaluation Committee.



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THE IMPORTANCE OF THE INITIAL INTERVIEW—ESTABLISHING CREDIBILITY QUICKLY WITH A NEW POTENTIAL CLIENT

ROBERT LINKUL, MS, CSCS,*D, NSCA-CPT,*D

The process of earning a new potential client's business starts with the client making some kind of contact to inquire about the personal trainer's services. Typically, the personal trainer will schedule a consultation and health appraisal with the potential client to learn about their health history, goals, needs, etc. Unfortunately, many trainers hurry through or skip right over the initial interview process to jump right into assessments of their new client. The initial interview is the starting point for the client-trainer relationship and sets the tone for the emotional connection and the development of trust and value for a long lasting professional relationship (2).

According to the *National Strength and Conditioning Association's Essentials of Personal Training* textbook, "during the initial interview, the personal trainer and client assess compatibility, develop goals, and establish a client-trainer agreement," (1). In today's fitness industry there is a great deal of focus placed on assessing a client's ability. So much that the initial interview is often underutilized and in some cases, not used at all. Developing a program and initiating a training program with a client that has not had their health history and fitness background disclosed to the personal trainer is a dangerous situation for all parties involved.

INITIAL INTERVIEW

The initial interview is typically the first time the personal trainer and client will meet in person. Although the initial interview can be performed over the phone, it is recommended that it be conducted in person to allow for more personal interaction. The initial interview is the moment in which both parties will decide if there is potential for a working relationship. This interaction sets the bar for all communications and interactions moving forward, therefore, setting the stage for the personal trainer and the client to make great first impressions. To start, the personal trainer should inquire about the client's basic information (e.g., phone number, email address, etc.) followed by four basic but, very helpful, questions that may generate a great deal of information from the client in a small amount of time.

1) "Does Anything Hurt?"

This is a great question to start with as the client typically thinks of an injury that is causing them the most pain or being the biggest burden at that time. A past or current injury could be a reason that the client is seeking out the personal trainer's services. This information may help a personal trainer understand which exercises to avoid. It can also be beneficial to ask if they know of any movements or exercises that specifically hurt when performed. Based on movements that elicit pain, the personal trainer can make modifications or refer to a physical therapist or qualified healthcare professional when necessary. Trainers should remember to refer a client to another health professional if they have an injury beyond their scope.

2) "What Physical Limitations Do You Have?"

Though similar to the first question, this question addresses other physical limitations that the client might have. These may be injuries or weakness that may be forgotten because it stems from an injury occurring a long time ago or because the discomfort is no longer bothering them on a regular basis. The personal trainer should work from head to toe asking about each joint. For example, "how does your neck feel," "do your shoulders move well," or "do you have any back issues or discomfort?"

3) "What Surgeries Have You Had?"

Inquiring about a client's past surgeries is another great reminder for clients to recall any minor or major injuries they have undergone. Clients may forget about surgeries that they have had if they were minor or a long time ago, especially if they are not still in pain from it. However, that information may be of importance to the personal trainer.

4) “What Medications, Vitamins, or Supplements Do You Take?”

Many medications, vitamins, and supplements can have various effects with exercise. It is vitally important to find out exactly what the client is currently taking. Any medications that send up a red flag (e.g., medications for blood pressure, anti-depressants, etc.) should be followed by a release note from the client’s doctor stating that they are allowed to exercise while taking this medication. The same goes for vitamins and other supplements, as some of these items may have negative effects on elevated heart rates or other physical reactions to exercise. Partnering and consulting with a Registered Dietitian is a great way for a personal trainer to determine if the vitamins and other supplements that a client may be taking are safe. It is important for personal trainers to understand that prescribing medication, vitamins, supplements, and dietary strategies is outside their scope of practice.

The purpose of these questions is to discover all of the physical issues or limitations the client has without doing so in a condescending way. It is the personal trainer’s job during the initial interview to collect as much information about the client in order to help them design, produce, and implement an appropriate program design specific to their goals.

It is important for the personal trainer to keep the initial interview “client-focused.” The personal trainer’s line of questioning should be very inquisitive and prompt answers that necessitate further explanation rather than “yes” or “no” answers. The more details the personal trainer can get from the client, the more successful they can be in determining the client’s program design, motivational techniques, and goal setting strategies. Once the personal trainer asks a question, they should remain quiet and allow the client to answer in full without any interruptions. The personal trainer should keep the conversation on track and guide the line of inquisition by asking follow-up questions that lead to more detailed answers and minimize personal stories and tangents. Once this line of questioning is completed, the personal trainer and client can turn their focus toward setting appropriate goals.

DEVELOPING GOALS

Goal development is necessary for program design because it can help keep the client focused during sessions and provide a way to assess progress. When working with the general population, common goals include losing body fat, gaining strength, and enhancing performance.

The personal trainer should make sure their client’s goals follow the “SMART” guidelines (specific, measurable, attainable, realistic, and time-based). For example, when writing the goal of losing body fat, the personal trainer could word it like this: “by training a minimum of three times per week and eating an appropriately healthy diet the client will lose 10 lb over the next six weeks.” These goals can be printed and posted on the wall in the gym (with the client’s permission) or can be stored into the personal trainer’s database for reference during future reassessments.

ESTABLISHING A CLIENT-TRAINER AGREEMENT

Many personal trainers call their agreement a contract. The term “contract” can be a rather intimidating term to use with a new client as it sounds binding, long-term, permanent, and inflexible. Instead, the personal trainer could use a less definitive word such as “agreement,” as it lends the feeling of two mutual parties coming together over one common goal. This agreement should outline the following items and terms of the agreement:

- How many sessions the client is going to purchase
- The price of each session or groups of sessions (as well as how the transactions will occur)
- The total investment including the initial interview and any other services purchased
- An outline of scheduling and business guidelines (e.g., cancelation policy, rescheduling policy, facility policies, etc.)
- Any legal terms that need to be highlighted (e.g., parties involved, signatures, dates, injuries, etc.)

CONCLUSION

The initial interview is a component of basic business practices that every personal trainer should do in order to operate a successful and professional business. By performing an effective initial interview, the personal trainer can begin to establish rapport with their clients. It is also an opportunity to acquire all of the information needed by the personal trainer to design and implement an appropriate training program for the client that is both safe and geared toward accomplishing their goals. Lastly, it is crucially important to discuss, sign, and store legal documents for how business will be conducted moving forward. It is the personal trainer’s responsibility to conduct themselves like a professional by performing these tasks.

REFERENCES

1. Evetovich, TK, and Hinnerichs, KR. Client consultation and health appraisal. In: Coburn, JW, and Malek, MH (Eds.) *NSCA’s Essentials of Personal Training* (2nd ed.). Champaign, IL: Human Kinetics; 147-151, 2012.
2. Linkul, R. Developing trust and value for personal trainers. *Performance Training Journal* 12(1): 7-9, 2011.

ABOUT THE AUTHOR

Robert Linkul was the National Strength and Conditioning Association’s (NSCA) Personal Trainer of the Year in 2012. He is currently a volunteer with the NSCA as the Southwest Regional Coordinator and Committee Chairman for the Personal Trainers Special Interest Group (SIG). Linkul is the Career Development columnist for the NSCA’s Personal Training Quarterly (PTQ) publication and speaks internationally on career development techniques for personal trainers. Linkul mentors personal training students and rookie trainers entering the industry on business strategies, client retention, and professional longevity. Linkul has been in the industry since 1999, and owns and operates his own personal training studio in Sacramento, CA.



TRAINING CONSIDERATIONS FOR ROWING ATHLETES

JACK CARTER AND CHAT WILLIAMS, MS, CSCS,*D, CSPS, NSCA-CPT, *D, FNSCA

Outdoor sports seem to be on the rise, and in particular, rowing seems to be gaining in popularity in recent years. Rowing is a physically demanding sport that utilizes the whole body to propel the boat through the water. Teamwork is of the utmost importance when rowing. All rowers must be in sync in order to maximize the efficiency in the water. In order to do this, the athletes must work together effectively. In order to understand the mechanics of rowing, the mechanics and steps of the stroke must be learned. The stroke in rowing is broken up into four parts: the catch, drive, finish, and recovery.

THE ROWING STROKE

The catch (Figure 1) begins with the athlete coiled forward on the sliding seat with the knees fully flexed and the arms fully outstretched. The catch concludes as the athlete drops the oar vertically into the water. The drive begins with the legs forcefully pushing into the foot restraints. The upper body does not change position and keeps the same forward posture (Figure 2). The work started by the legs is transferred through the core as the athlete leans back, and concludes with the arms pulling the handle toward the chest, or the blade through the water (Figure 3). The finish is the transition between the drive and the recovery where the oar blades must be removed from the water. During this phase, the athlete's hips and knees are in extension and leaned back. The athlete pushes the oar handle down which removes the blade from the water. As the oar blade exits the water, the blade is feathered (moved from a vertical to a horizontal position) (Figures 4 and 5). The recovery (Figure 6) brings the athlete back to the

coiled position of the catch at the beginning of the stroke. As the athlete slides forward, the feathered blade is returned to a vertical position. When these steps are all performed properly and smoothly, the boat should move through the water seamlessly.

Depending on the race length and number of practices, the athlete could be put into this coiled or flexed position hundreds or thousands of times. This places extra importance on performing the movement properly even when stressed or fatigued. If the athlete performs the movement in a dysfunctional manner, it could lead to a higher risk of experiencing low-back pain or injury. Research has indicated that low-back pain costs over 100 billion dollars annually in the United States (2). Furthermore, 70 – 90% of low-back pain subsides within 2 – 3 months, but can reoccur in 25 – 60% of people within the following 12 months (4).

LOW-BACK PAIN

Low-back pain is multifactorial and can be the root of many underlying conditions. If the athlete has tight hips and a tight upper back, then their body may sacrifice stability in the low back in order to perform the desired movement. With the movement and instability in the presence of load, degenerative changes can occur in this area (1). Nadler et al. found that athletes with low-back pain performed subpar on a 20-m shuttle test leading to the thought that this condition can cause issues even if the symptoms are not apparent immediately after the exercise session (5). Strength and conditioning professionals have their hands full with the rowing athlete in this case. A strength and conditioning

professional should find a way to design a workout that challenges the athlete safely, while also progressing them closer to reaching their goal.

WARM-UPS

One way to help the strength and conditioning program to be successful is through a quality warm-up prior to each workout session. Tables 1 and 2 show a basic warm-up for a beginner rowing athlete that consists of self-myofascial release, stretching, and active warm-up exercises. This warm-up routine primes and prepares the body for the rigors of the subsequent workout.

TRAINING PROGRAM FOR ROWERS

Tables 3 and 4 provide a sample resistance training program for the rowing athlete. These workouts utilize big multi-joint movements with an emphasis on quality movement and kinesthetic awareness.

Conditioning is also an important aspect that should be addressed in the program. Conditioning is a measure of how well an athlete is able to meet the energy production demands of their sport (3). A typical rowing race is 500 m, which usually takes an eight-person team 1:50 – 2:30 min to complete. The energy system requirement for rowers is geared more towards the anaerobic energy system. One of the limiting factors in rowing is starting power, hence the focus on anaerobic power. If an error occurs at the start of the race, it can be very difficult to make up the time in a 500-m race.

By having specific conditioning training in the program, the rowing athlete can develop the energy system that they will use in competition. Table 5 consists of exercises that are specific for a conditioning workout that can be used in tandem with the resistance exercise workouts.

CONCLUSION

Rowing is a physically demanding sport that requires its own unique training parameters to maximize performance. Strength and conditioning professionals should fully understand the components of the rowing stroke before working with rowing athletes. It is recommended that strength and conditioning professionals train their rowers with a targeted warm-up routine, specific resistance training exercises, and supplemental conditioning training to help reduce injury risk and optimize performance.

REFERENCES

1. Cholewicki, J, Penjabi, MM, and Khachatryan, A. Stabilizing function of trunk flexor – Extensor muscles around a neutral spine posture. *Spine* 22(19): 2207-2212, 1997.
2. Crow, WT, and Willis, DR. Estimating cost of care for patients with acute low back pain: A retrospective review of patient records. *Journal American Osteopathic Association* 109(4): 229-233, 2009.
3. Jameson, J. *Ultimate MMA Conditioning*. 8WeeksOut Media, 2009.
4. Marshall, PWM, Desai, I, and Robbins, DW. Core stability exercises in individuals with and without chronic nonspecific low back pain. *The Journal of Strength and Conditioning Research* 25(12): 3404-3411, 2011.

5. Nadler, SF, Moley, P, Malanga, GA, Rubbani, M, Prybicien, M, and Feinberg, JH. Functional deficits in athletes with a history of low back pain: A pilot study. *Archives of Physical Medicine and Rehabilitation* 83(12): 1753-1758, 2002.

ABOUT THE AUTHOR

Jack Carter is the Evening Supervisor and Performance Coach for Norman Regional Health Club. He has served as the National Strength and Condition Association (NSCA) Oklahoma State Director (2008 – 2013) and has lectured locally and nationally on various topics in the strength and conditioning field. His work over the last 15 years has lead him to specialize in helping athletes return from both acute and chronic injuries. He works closely with orthopedics and therapists to create an environment for athletes to learn and excel physically and mentally.

Chat Williams is the Supervisor for the Norman Regional Health Club. He has served as a member of the National Strength and Conditioning Association (NSCA) Board of Directors, NSCA State Director Committee Chair, Midwest Regional Coordinator, and State Director of Oklahoma (including being named the 2004 State Director of the Year). He also served on the NSCA Personal Trainers Special Interest Group (SIG) Executive Council. He is the author of multiple training DVDs. Williams also runs his own company, Oklahoma Strength and Conditioning Productions, which offers personal training services, sports performance for youth, metabolic testing, and educational conferences and seminars for strength and conditioning professionals.

TRAINING CONSIDERATIONS FOR ROWING ATHLETES

THE CATCH (FIGURE 1)

In the catch, the athlete sits with the knees bent, shoulders in front of the hips, and the arms outstretched fully. This position also gets the athlete ready for the next phase, the drive.



FIGURE 1. THE CATCH

THE DRIVE (FIGURES 2 AND 3)

The drive begins with the legs forcefully pressing into the foot restraints. The upper body will maintain the forward lean until the hands go past the knees. The force produced by the legs will be transferred via the backward lean and finally the pulling of the handle toward the chest to complete the drive.



FIGURE 2. THE DRIVE - START

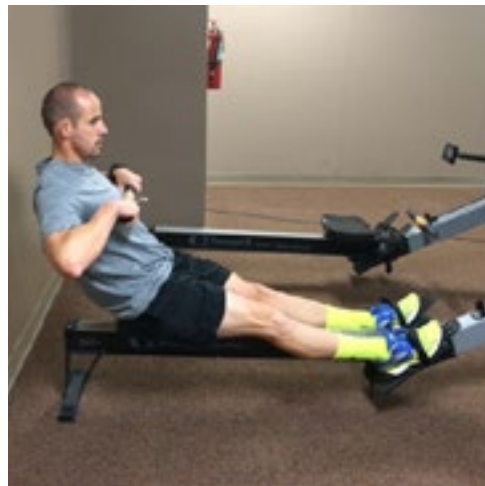


FIGURE 3. THE DRIVE - FINISH

THE FINISH (FIGURES 4 AND 5)

The finish is the beginning of the recovery. While recoiling into the flexed position, the athlete should feather the blade out of the water. As the handle of the oar passes the knees, it is squared back up and ready to enter the water.



FIGURE 4. THE FINISH - START



FIGURE 5. THE FINISH - FINISH

THE RECOVERY (FIGURE 6)

The recovery occurs when the athlete returns to the starting position of the catch and as the squared blade returns to the water.



FIGURE 6. THE RECOVERY

GOBLET SQUAT (FIGURE 7)

Goblet squats begin with the kettlebell held up in front of the chest and the feet shoulder-width apart. Begin the descent by flexing at the hips and knees. Extend through the hips and knees to return to a standing position.



FIGURE 7. GOBLET SQUAT

KETTLEBELL DEADLIFT (FIGURES 8 AND 9)

The kettlebell deadlift is a great hip dominant exercise. The athlete should start with the kettlebell handles even with the heels. The athlete should grip the handle tight and keep the spine (including the neck) in a neutral position. Keep the weight in the heels while standing up by extending the hips. The athlete should keep the ears, shoulders, and hips in line. Return the kettlebell to the starting position.



FIGURE 8. KETTLEBELL DEADLIFT - START

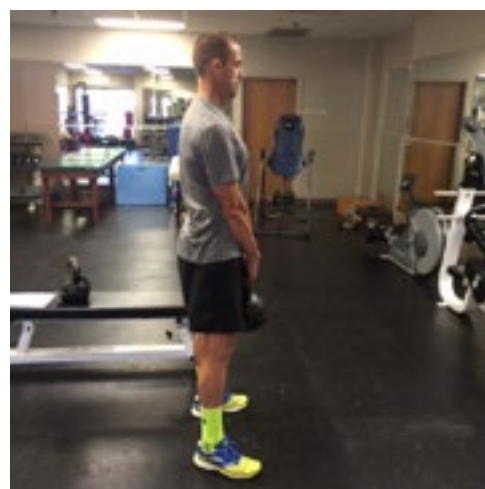


FIGURE 9. KETTLEBELL DEADLIFT - FINISH

TRAINING CONSIDERATIONS FOR ROWING ATHLETES

TALL KNEELING PALLOF PRESS (FIGURES 10 AND 11)

The tall kneeling Pallof press is an anti-rotation exercise. The athlete should keep the knees, shoulders, and ears in line. The athlete should press the band out in a manner similar to a chest press. The athlete should stay tall and resist the rotational torque placed on the body.



FIGURE 10. TALL KNEELING PALLOF PRESS – START



FIGURE 11. TALL KNEELING PALLOF PRESS – FINISH

HALF GET-UP (FIGURES 12 – 15)

Start with the kettlebell straight over the shoulder with the arm extended fully. Extend the opposite arm out 45 degrees from the body and press it into the ground (Figure 12). Drive through the foot of the flexed knee and rotate up to the elbow to start the half get-up (Figure 13). The athlete should keep the chest high, the core tight, and the shoulder under the kettlebell. Keeping the eyes on the kettlebell will help keep the neck in proper position during the exercise. The athlete should extend the supporting arm and find the ground with their hand while continuing to keep the chest high and eyes on the kettlebell (Figure 14). The final part of the half get-up is to extend the hips up off the ground (Figure 15). Reverse the order back to the beginning to complete one repetition.



FIGURE 12. HALF GET-UP



FIGURE 13. HALF GET-UP



FIGURE 14. HALF GET-UP

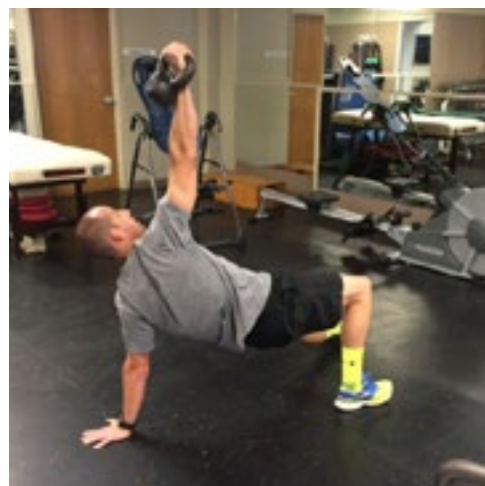


FIGURE 15. HALF GET-UP

TABLE 1. SAMPLE FOAM ROLLING ROUTINE FOR SELF-MYOFASCIAL RELEASE

AREA	DURATION	NOTES
Calves	20 – 120 s each leg	Roll the soleus and gastrocnemius; internally and externally rotate the leg to get all aspects of the lower leg.
Thighs	30 s each quadrant	The four quadrants are the hamstrings, outer thigh, hip flexors/front of the leg, and adductors.
Hips/Glutes	20 – 120 s each leg	To get deeper into the hip, externally rotate the hip.
Upper Back	20 – 120 s	When foam rolling the upper back, giving the torso a big hug will help to pull the scapulae out of the way. A mobilization technique that can be helpful is to lie with the roller right below the scapulae and drop the hips to the floor. With fingers laced behind the head, try to touch the head to the ground. This helps get the extension back in the thoracic region. Do a few repetitions then rotate the foam roller 45 degrees, this helps get the rotation back in the thoracic spine.
Lats	20 – 30 s each side	Lie with the foam roller positioned right under the back of the armpit. Roll down to the bottom lateral border of each scapula.
Feet	60 s each foot	Use a handball or tennis ball to roll out the bottoms of the feet. As with the foam roller, find and concentrate on the tender spots.

TRAINING CONSIDERATIONS FOR ROWING ATHLETES

TABLE 2. SAMPLE STRETCHING AND ACTIVE WARM-UP

EXERCISE	VOLUME	NOTES
World's Greatest with Thoracic Spine Mobility	1 x 5 each side	Start in a push-up position with the right leg to the outside of the right hand. Squeeze the glutes and push the chest toward the ground. Keep the neck neutral. To add in the thoracic spine mobilization, rotate the left arm up and around. Keep the neck neutral and eyes on the left hand. Do five repetitions then switch to the other side.
Bird Dogs	2 x 10 each side	Hold the extended position for an exhale of 2 s.
Walking High Knee Pulls	2 x 20 yards	With each step, extend the ankle of the supporting leg as the opposite knee is pulled up to the torso.
Ankle Jumps (Forward and Backward)	2 x 15 s	Use a line on the field or floor. Jump over and back as many times as possible in the given amount of time. Try to keep the center of mass over the line.
Medicine Ball 3-Direction Squats	2 x 3 each	Sagittal plane: hold the medicine ball out in front and squat as deep as possible with good form. Frontal plane: widen the feet and sit with the hips towards the heel of the right foot. Perform for full range then return to the start and repeat movement on the opposite side.
Walking Hip Flexor Stretches with a Reach	2 x 20 yards	Grab the left ankle with the left hand by flexing the knee. With a tall spine, flex at the hips so the head moves forward and a stretch is felt on the left side and hamstring/glute activation on the right side. Come back up to standing, take three steps and repeat with the opposite leg.
Ankle Jumps (Side to Side)	2 x 15 s	Use a line on the field or floor. Jump side to side as many times as possible for the given time. Try to keep the center of mass over the line.

TABLE 3. SAMPLE WORKOUT—RESISTANCE TRAINING DAY 1

EXERCISE	SETS X REPS
Goblet Squats	3 x 8
Lat Stretches	3 x 5 breaths each side
T-Bar Rows	3 x 10
Incline Dumbbell Presses	3 x 8
Deep Squats with Single-Arm Overhead Reach	3 x 3 each side
Sled Pushes	3 x 20 yards
Medicine Ball Slams	3 x 10
Push-Ups	3 x 8
Stability Ball Bridges	3 x 10 breaths (more challenging progression: 3 x 10 roll-outs on stability ball)

TABLE 4. SAMPLE WORKOUT—RESISTANCE TRAINING DAY 2

EXERCISE	SETS X REPS
Kettlebell Deadlifts	3 x 8
Half Get-Ups	3 x 3 each side
Single-Arm Dumbbell Rows	3 x 10 each side
Farmer's Walks	3 x 40 yards
Step Back Lunges with Reach	3 x 5 each leg
Single-Arm Landmine Presses	3 x 8 each arm
Closed Grip Pulldowns	3 x 10
Tall Kneeling Pallof Presses	3 x 10 each side

TABLE 5. SAMPLE CONDITIONING WORKOUT

EXERCISE	SETS	WORK	GOAL	RECOVERY	ENERGY SYSTEM EMPHASIS
Stationary Bike	3	0.2 mi	Less than 35 s	1 min or heart rate below 130	Anaerobic
Rowing Erg	3	500 m	Less than 70 s	1 min or heart rate below 130	Anaerobic
Rowing Erg	1	2,000 m	8 – 9 min	N/A	Aerobic capacity



GIVING THE CLIENTS WHAT THEY WANT— A PERSONAL PERSPECTIVE

RYAN CARVER, CSCS

Every client that comes in the door has their own specific goals, whether it is to lose weight, build muscle, improve balance, etc. It is the job of the personal trainer to help their clients reach that goal in a safe and effective manner. However, personal trainers can sometimes lose sight of the big picture of a client's life and have tunnel vision on specific training aspects that may not matter.

When I first started as a personal trainer almost 10 years ago, my boss taught me a valuable skill in keeping clients happy and coming back for years. At the time, I listened but I did not realize the pricelessness of the advice until after I started talking to others in the industry. He had been in business for more than 15 years and was still training many of the clients he started with. To this day, I try to heed his advice by asking two simple questions each session with each client: “how are you feeling?” and “what do you feel you need most today?”

HOW ARE YOU FEELING?

This question is more than simple chitchat. You want to get an update of their overall wellbeing (e.g., physically, emotionally, mentally, etc.). This happens by sincerely listening to what they have to say. As Stephen Covey says in his book, *The 7 Habits of Highly Successful People*, “seek first to understand, then to be understood,” (2). If the client does not respond specifically, the personal trainer should follow-up with additional questions pertaining to previous injuries, how much sleep they have been getting recently, or other questions that make it personal.

The purpose of asking this question is to get a quick gauge of their state of body and mind before jumping into the workout. It is very common for personal trainers to get started with a session and after several minutes, they notice that something is off with the client that day. At this point, the personal trainer asks the important question: “How are you feeling?” or “I notice something seems off. What's going on?” If the personal trainer simply asked the question at the beginning of the session, they would likely not have to change plans midsession and the training session would have a better chance for greater flow and consistency. For example, I recently asked a client the “how are you feeling” question and found out they had done a monster hike the day before and were suffering from delayed onset muscle soreness (DOMS) in their legs. This meant that the original plan of going for a personal record on squats was out the window, and the session was adapted to their needs.

WHAT DO YOU FEEL LIKE YOU NEED MOST TODAY?

When I was right out of college, I would write very specific programs for all my clients. Very quickly, I found myself frustrated. For some reason, my clients were not adhering to the program or would come into a session and not be on their “A” game. Finally, I realized that it is fine to have goals I want the client to accomplish in a given workout or week, but I needed to be more flexible in specific prescription. This flexible approach along with asking this question has proved to be a great strategy for dealing with clients.

It is fair to say that individual clients know their bodies better than the personal trainer does. If they tell the personal trainer what is going on with them and what they need, it can save a lot of time and effort, and may help in allowing the client to achieve their goals. Without asking this question, the personal trainer has to rely solely on guesswork or how the client is moving in a session. However, this input from the client should not dictate the programming but rather help the trainer better plan around the client's wellbeing and current state (physical and emotional).

This question does come with two caveats. First, the personal trainer must be prepared with a solid, yet flexible, workout before asking the question. If the personal trainer is not willing to change the workout plans, they should not bother asking. A great follow-up statement I use right after asking the questions is: "I have a couple different ideas, but I wanted to get your input first." For example, I recently used this follow-up with a client giving him three different options. He picked two of them that he wanted to do that session, and the third option he chose to do in the next session. Overall, he got what he wanted while sticking to the program and staying on target for reaching his goals.

Second, there will always be those clients who do not want to push themselves and want to take the easy way out. Although it is tempting, personal trainers should not ignore asking either of these questions to these particular clients. In this situation, the personal trainer has a couple of options: they can talk about the client's goals and discuss whether their "needs" at the moment are going to help with those goals, or the personal trainer could try to adapt their training session in a different way than normal while still adhering to the training strategy.

As an example, I have a client who is always stressed and always asks for something easy each session to help cope with the stress. For a while we did yoga, foam rolling, etc. but she was not working towards her goal of building strength and stamina. The next time she told me this, I switched it up. Instead of doing weights (original goal) or yoga/mobilization training (usual result), I had her do some bodyweight/lighter weight compound movements, really focusing on range of motion. She found that she loved this compromise. Additionally, she achieved all her goals for the session, felt less stressed, and worked towards her long-term goal of increased strength and stamina.

WHY THIS WORKS

First and foremost the personal trainer must recognize that the client is the boss and the personal trainer is their employee. The client is ultimately in charge and they have the power to "fire" the personal trainer at any time. If the personal trainer keeps their boss happy with their work, they are more likely to stay "employed."

Second, by asking these questions, the personal trainer gives their client an active role in their workout, their goals, and the process as a whole. In other words, the personal trainer makes it about the client. Deci and Ryan call this autonomy in their self-determination theory (3). Autonomy, in this case, essentially means that the client believes that they have the power of decision-making. This autonomy may reduce the dread of the workout, complaining, resting as much as they can get away with, or even the view that the personal trainer is the enemy. If the client has autonomy, they

are more likely to have better attitudes and push themselves harder with less coercion on the part of the personal trainer (3). Bandura in his self-efficacy theory said, "Among the mechanisms of personal agency, none is more central or pervasive than people's beliefs in their capability to exercise some measure of control over their own functioning and over environmental events," (1). Therefore, it is very important for personal trainers to give their clients the opportunity to make some decisions about their training sessions so they can be a more active participant both mentally and physically.

CONCLUSION

It is important for personal trainers to remember why the client hired them in the first place. It was probably to get help in reaching some sort of physical goal. When a personal trainer asks the client what they need and the personal trainer delivers, they have just given them the exact results for which they have agreed upon and paid. If the clients are always getting exactly what they want and need, the personal trainer has a better chance of retaining them as clients for a long time.

REFERENCES

1. Bandura, A. Social cognitive theory: An agentic perspective. *Annual Review of Psychology* 52: 1-16, 2001.
2. Covey, SR. *The 7 Habits of Highly Effective People*. Free Press, 2004.
3. Deci, EL, and Ryan, R. 2011. Self-determination theory. In: Van Lange, PAM, Kruglanski, AW, and Higgins, ET (Eds.), *Handbook of Theories of Social Psychology: Collection: Volumes 1 and 2*. SAGE Publications; 416-433.

ABOUT THE AUTHOR

Ryan Carver is a fitness coach and independent personal trainer. He was a collegiate athlete and spent one season in the American Ultimate Disc League (AUDL). He received his Bachelor's degree in Exercise Science with a minor in Nutrition from the University of Utah. He is a Certified Strength and Conditioning Specialist® (CSCS®) and a Functional Aging Specialist through the Functional Aging Institute (FAI). Carver is the founder of Leverage Fitness Solutions, which helps corporations and individuals achieve a healthy and sustainable lifestyle.



PERSONAL TRAINING FOR THE SEDENTARY OFFICE WORKER

RYAN MCCLURE, CSCS, NSCA-CPT, AND BRYAN JACKSON, MS, CSCS, NSCA-CPT, USAW

Most people in the United States reported in 2014 that they were not meeting all of the current federal physical activity guidelines (19). It is well documented that a sedentary lifestyle, like that of a typical office worker, can contribute to a number of negative health consequences such as cardiovascular disease and low back pain (5,15). There is not substantial proof that a sedentary lifestyle by itself causes low back pain; however, there is research that shows that a high percentage of sedentary office workers suffer from low back pain. The personal trainer can play an important role in preventing some of these negative effects by being aware of health concerns and taking systematic action to prevent them from occurring.

LOWERING THE RISK OF CARDIOVASCULAR DISEASE

The Centers for Disease Control and Prevention (CDC) reported that cardiovascular disease was the number one killer of Americans in 2010, and preliminary data points to this still being the case currently (13). Despite the evidence linking regular physical activity to various degrees of cardiovascular health, a majority of adults in the United States remain sedentary and less than one-third meet the minimal recommendations for activity outlined by the CDC, American College of Sports Medicine (ACSM), and American Heart Association (AHA) (14,17,22,23). In addition, excessive sitting has been associated with the risk for chronic disease and premature death even after controlling for time spent in leisure exercise or moderate to vigorous physical activity (12). Personal trainers are likely to work with individuals that are not only sedentary in their recreational time, but also sit

for a majority of their working day. Due to this, personal trainers should work to develop comprehensive programs for clients that not only focus on areas that can be addressed during training sessions but also help with strategies that clients can incorporate into their daily routines.

Prevention of cardiovascular disease should be a primary concern of personal trainers when working with sedentary clients like those who hold office jobs. There are numerous factors that may contribute to cardiovascular disease, such as smoking, genetics, obesity, or a combination of other factors. Even though a personal trainer cannot control for all factors associated with cardiovascular disease, they can potentially limit some of the risk factors by encouraging better lifestyle choices like smoking cessation, weight management, and increased activity levels in daily life and during exercise sessions. Many people are educated about the research linking inactivity to cardiovascular disease, but they may not be motivated to make changes or become properly educated on strategies to increase activity—this is where the personal trainer can make a positive impact.

Personal trainers should take the opportunity during discussions with their clients to offer suggestions on ways to move more during their work day and during their free time away from work. Table 1 offers some ideas that clients can use at work to increase their activity levels. It is critical to understand that what happens during the approximate 16 hours of daytime is equally if not more important than what happens in an hour long training session a

few times per week. Personal trainers should take advantage of every opportunity to educate their clients on lifestyle choices that can benefit their cardiovascular health.

Two mainstream options for improving cardiovascular fitness are continuous endurance exercise and high-intensity interval training (HIIT). Continuous endurance exercise may be defined as 20 min or longer of cardiovascular activity at a steady-state level of intensity. HIIT may be defined as the combination of high-intensity intervals ranging from less than 10 s to several minutes interspersed with low-intensity recovery periods of equal time or longer. Both options are an effective means of improving cardiorespiratory fitness, although in some studies HIIT training has been shown to be more effective (8,24).

When deciding whether or not to incorporate HIIT into personal training sessions, several factors must be analyzed. When working with a population like sedentary office workers, personal trainers should understand that these people might have a limited amount of time that they can devote to exercise. Because of this time limitation and the potential physiological benefits, HIIT training may be more effective for busy populations. Table 2 provides a sample of a weekly workout program that can be completed in 30 min per session. However, HIIT protocols could be dangerous for people who are not fit and able to handle the program intensities. Overtraining and injuries are possible when a program is not individualized and when a client is not progressed properly. Personal trainers should understand their individual clients and ensure that their programs fit their current needs and level of fitness, while progressing safely to new levels of fitness. It should also be noted that “high intensity” is a relative term to every individual’s fitness level. When performing HIIT, the personal trainer should have their client perform high-intensity intervals that are at an appropriate high intensity for that specific client.

Because benefits have been shown for both steady-state endurance training and HIIT, it may be appropriate to incorporate both of the methods into a client’s overall training regimen. However, clients typically do not want to perform steady-state cardiovascular activity with a personal trainer when they are paying the trainer to aid and monitor other more complicated aspects of their routine. Steady-state cardiovascular training has a place in the exercise program of office workers, although in some cases it may be best utilized outside of the personal training session. Personal trainers can use their influence and training knowledge to motivate and educate their clients to perform consistent, steady-state cardiovascular exercise on their own time. It is important to note that a good training program alters intensity, volume, and frequency of training in a periodization plan to meet the goals of specific clients properly. This is another good reason for a personal trainer to encourage both HIIT and steady-state aerobic exercise.

If a client has already developed cardiovascular disease, then a personal trainer should take extra caution in the evaluation process and in program design. A client with cardiovascular disease or symptoms of cardiovascular disease should always be cleared by a medical professional before exercising. In these cases, HIIT may be inappropriate and unsafe. The above guidelines are only general guidelines, and a personal trainer should never

assume that all of these recommendations and training systems are effective and safe for all of their clients.

LOWERING THE INCIDENCE OF LOW BACK PAIN

Much like cardiovascular disease, low back pain (LBP) is an extensive health concern in the United States with 70 – 85% of adults suffering from LBP at some point in their lives and an approximate 15% – 45% of people suffering from LBP every year (2). One large group with high odds of developing LBP is sedentary office workers; in fact, LBP was reported by 34% of office workers in a 2008 study by Janwantankul et al. (9). Additionally, office workers who use computers extensively and sit the majority of the time at work with awkward postures, such as a forward-bent trunk position, have an increased potential of developing LBP (11,16,21). LBP can result in missed days at work, reduced ability to perform routine daily activities, and high medical expenses (1,10,18).

To help prevent the onset of LBP, personal trainers can be proactive with their training of office workers by using preventative exercises during training sessions and encouraging lifestyle changes like weight loss, increased physical activity, smoking cessation, and posture improvement while sitting (11,20,21). The goal is to prevent individuals from ever reaching the level of moderate to severe LBP by properly training and educating them. If an individual already suffers from LBP, a personal trainer may be able to reduce the effects. However, it is very important to remember that all cases of LBP should first be analyzed and treated by medical professionals followed by a referral to a personal trainer.

The focus of the next section will be the prevention of LBP through lifestyle change and proactive core training. The educational and training program suggestions below are general points that may be used as a guideline for trainers but do not apply in every situation because of the complexity of lower back issues and the various differences in strength, flexibility, body type, previous injuries, age, ability levels, and numerous other factors of individual clients.

PREVENTION THROUGH LIFESTYLE CHANGE AND TRAINING

One of the priorities of a trainer working with a sedentary office worker should be to educate the client on the importance of their posture while at work and during times of prolonged sitting, as well as the benefit to adjusting posture frequently. LBP in office workers can stem from sustained spinal flexion, among other causes, where the worker rolls the shoulders forward and rounds the back (7,11). A recent study showed a negative effect on lumbar disks, specifically disk height which may correlate with LBP, after prolonged sitting without intermittent breaks (4). A trainer can help with this by showing their clients pictures of different sitting postures and by having their clients practice them while resting during training sessions. Trainers can also express the benefit of changing position or posture every 15 min or so (4). See Figures 1 and 2 for an example of different desk sitting postures. The client must understand that it is not only the training sessions that are important in preventing or reducing LBP but also consistent ideal postures in daily life and potentially many other controllable and uncontrollable factors. However, ideal postures in sitting, standing, and other activities may depend on the individual’s anatomy and

injury history.

Another area that trainers can potentially make a difference outside of the training session is by encouraging their clients to move more during the work day. This is important considering that cardiovascular disease and LBP may be linked to disuse syndrome, or too much sitting (3). There does not appear to be clear proof in scientific research that moving more can reduce or prevent LBP, but many medical professionals recommend that their patients engage in more movement throughout the day to reduce LBP. Regardless of whether or not moving more at work decreases or helps prevent LBP, more movement is beneficial because of the positive impact it has on weight loss or maintenance and cardiovascular health (6).

Personal trainers can assist their clients in training the core muscles to withstand everyday activities such as sitting for prolonged periods. Because the office worker typically sits for most of the day using different postures, the core should be trained to withstand that rigor. Therefore, it may be more important to train the core for endurance rather than strength or power in this population. This necessitates higher repetitions with short rest periods or isometric holds for long periods of time with short rest periods. However, it is important to discontinue a core exercise when an individual begins using improper technique because of fatigue. This may help prevent injury and allow the client to continue to use good posture throughout the exercise session.

When working the core muscles for posture improvement in the office, it may be ideal to focus on “open” core exercises with isometric components because these exercises promote a neutral back rather than a flexed, rounded back that is common in “closed” core exercises. Examples of open core exercises include variations of planks, some stability ball exercises (Figures 3 and 4), and numerous isometric holds or movements that involve multiple muscle groups (Figures 5 and 6). Examples of closed core exercises that do not promote a neutral back and good posture include sit-ups and crunches. It should be mentioned that there is no longitudinal research comparing the effects of open versus closed core exercises on sitting posture or low back pain.

The posterior chain (i.e., the back side of the body) is another area that should be adequately trained to improve posture and may potentially prevent the onset of LBP. Upper body pull exercises and farmer’s walks are good exercises to use for replicating the shoulders being pulled back while a worker sits at their desk (Figures 7 – 9). A good rule of thumb for training office workers is to incorporate more upper body pull exercises than upper body push exercises during training sessions. Proper resistance training exercises also promote good posture when done correctly, so it is important for personal trainers to encourage proper technique by instructing their clients to keep a neutral back in most instances (e.g., barbell squat, shoulder press). The back should never be rounded during most exercises and the shoulders should not round forward during most resistance training exercises.

Low back issues can stem from various sources that may be out of the personal trainer’s area of expertise and scope of practice. When personal trainers have clients who have already developed LBP, personal trainers should personalize training programs to meet the specific needs of their individual clients based on the guidelines provided by medical professionals. The above recommendations are general steps that may be taken to help prevent or reduce LBP and are certainly not all-inclusive, nor should they be incorporated in every situation. Many other factors have been studied as possible causes of LBP, but are outside the scope of this article. There is ample research available on the topic of LBP that can be studied in a personal trainer’s attempt to provide safe, effective, and specific programming for their individual client’s unique situations.

CONCLUSION

No training program can completely eliminate the risk of cardiovascular disease or LBP, but some steps can be taken to decrease the likelihood of being afflicted by either. Personal trainers can use their influence to encourage their clients to make better lifestyle choices like moving more at work and during free time away from work. Steady-state aerobic exercise and HIIT are effective in improving cardiorespiratory fitness and can be dually incorporated into a client’s overall training program. Personal trainers should work with their clients to figure out ideal postures and encourage them to use these postures throughout the day at work, keeping in mind that changing postures may be important for preventing LBP during prolonged sitting. The core musculature can be trained in an “open core” fashion using endurance principles to mimic the sitting positions that require active muscular contractions. Strengthening the posterior chain is also important in maintaining good posture and potentially preventing LBP. As with all training programs, trainers should consider clients on an individualized basis while using proper progression to keep clients safe. Anyone with a current disease or signs and symptoms of a disease should first be cleared by an appropriate medical professional before starting with a personal trainer.

REFERENCES

1. Andersson, GBJ. Epidemiologic features of chronic low-back pain. *Lancet* 354(9178): 581-585, 1999.
2. Andersson, GBJ. The epidemiology of spinal disorders. In: Frymoyer, JW (Ed.). *The Adult Spine: Principles and Practice* (2nd ed.) New York, NY: Raven Press; 93-141, 1997.
3. Atlas, SJ, and Volinn, E. Classics for the spine literature revisited: A randomized trial of 2 versus 7 days of recommended bed rest for acute low back pain. *Spine* 22(20): 2331-2337, 2007.
4. Billy, GG, Lemieux, SK, and Chow, MX. Changes in lumbar disk morphology associated with prolonged sitting assessed by magnetic resonance imaging. *PM&R* 6(9): 790-795, 2014.
5. Booth, FW, Gordon, SE, Carlson, CJ, and Hamilton, MT. Waging war on modern chronic diseases: Primary prevention through exercise biology. *Journal of Applied Physiology* 88(2): 774-787, 2000.

6. Garber, CE, Blissmer, B, Deschenes, MR, Franklin, BA, Lamonte, MJ, Lee, I, et al. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. *Medicine and Science in Sports and Exercise* 43(7): 1334-1359, 2011.
7. Hartvigsen, J, Leboeuf-Yde, C, Lings, S, and Corder, EH. Is sitting-while-at-work associated with low back pain? A systematic, critical literature review. *Scandinavian Journal of Public Health* 28(3): 230-239, 2000.
8. Helgerud, J, Hoydal, K, Wang, E, Karlsen, T, Berg, P, Bjerkaas, M, et al. Aerobic high-intensity intervals improve VO₂max more than moderate training. *Medicine and Science in Sports and Exercise* 39(4): 665-671, 2007.
9. Janwantanakul, P, Pensri, P, Jiamjarasrangsi, W, and Sinsongsook, T. Prevalence of self-reported musculoskeletal symptoms among office workers. *Occupational Medicine* 58(6): 436-438, 2008.
10. Katz, JN. Lumbar disc disorders and low-back pain: Socioeconomic factors and consequences. *Journal of Bone and Joint Surgery American* 88(Suppl 2): 21-24, 2006.
11. Lis, AM, Black, KM, Korn, H, and Nordin, M. Association between sitting and occupational LBP. *European Spine Journal* 16(2): 283-298, 2007.
12. Lynch, BM, and Owen, N. Too much sitting and chronic disease risk: Steps to move the science forward. *Annals of Internal Medicine* 162(2): 146-147, 2015.
13. Murphy, SL, Xu, J, and Kochanek, KD. Deaths: Final data for 2010. *National Vital Statistics Report* 61(4): 2013.
14. Myers, J. Exercise and cardiovascular health. *Circulation* 107: e2-e5, 2003.
15. Myers, J, Prakash, M, Froelicher, V, Dat, D, Partington, S, and Atwood, JE. Exercise capacity and mortality among men referred for exercise testing. *New England Journal of Medicine* 346(11): 793-801, 2002.
16. Ortiz-Hernández, L, Tamez-González, S, Martínez-Alcántara, S, and Méndez-Ramírez, I. Computer use increases the risk of musculoskeletal disorders among newspaper office workers. *Archives of Medical Research* 34(4): 331-342, 2003.
17. Physical Activity Guidelines Advisory Committee. *Physical Activity Guidelines Advisory Committee Report*, 2008. Washington, DC: U.S. Department of Health and Human Services; 2008.
18. Praemer, A, Furnes, S, and Rice, DP. Musculoskeletal conditions in the United States. Rosemont: AAUS; 1-99, 1992.
19. Schiller, JS, Ward, BW, Freeman, G, and Clarke, TC. Early release of selected estimates based on data from the January – June 2014 National Health Interview Survey. 2014. Accessed September 24, 2015 from <http://www.cdc.gov/nchs/data/nhis/earlyrelease/earlyrelease201412.pdf>.
20. Shiri, R, Karppinen, J, Leino-Arjas, P, Solovieva, S, and Viikari-Juntura, E. The association between smoking and low back pain: A meta-analysis. *American Journal of Medicine* 123(1): e7-e35, 2010.
21. Spyropoulos, P, Papathanasiou, G, Georgoudis, G, Chronopoulos, E, Koutis, H, and Koumoutsou, F. Prevalence of low back pain in Greek public office workers. *Pain Physician* 10(5): 651-659, 2007.
22. Sui, X, LaMonte, MJ, and Blair, SN. Cardiorespiratory fitness as a predictor of nonfatal cardiovascular events in asymptomatic women and men. *American Journal of Epidemiology* 165(12): 1413-1423, 2007.
23. Sui, X, LaMonte, MJ, Laditka, JN, Hardin, JW, Chase, N, Hooker, SP, and Blair, SN. Cardiorespiratory fitness and adiposity as mortality predictors in older adults. *Journal of the American Medical Association* 298(21): 2507-2516, 2007.
24. Wisloff, U, Ellingsen, O, and Kemi, OJ. High-intensity interval training to maximize cardiac benefits of exercise training? *Exercise Sport Science Review* 37(3): 139-146, 2009.

ABOUT THE AUTHOR

Ryan McClure is a Fitness Representative and Personal Trainer at Chesapeake Energy Corporation in Oklahoma City, OK. During his one year at Chesapeake, he has worked with youth and adult populations to enhance health, fitness, and strength and conditioning. Previously, McClure was the Supervisor and a Strength and Conditioning Coach at Youth Performance, a facility for elementary school, middle school, and high school athletes. In his three and a half years at Youth Performance, McClure worked with numerous state champions and athletes who went on to play collegiate sports. He holds a Bachelor of Science degree in Health and Exercise Science from the University of Oklahoma and is certified through the National Strength and Conditioning Association (NSCA) as a NSCA-Certified Personal Trainer® (NSCA-CPT®) and Certified Strength and Conditioning Specialist® (CSCS®). He can be reached for questions or comments at ryan@youthperformance.net.

Bryan Jackson holds a Master's degree in Wellness Management – Exercise Science from the University of Central Oklahoma. He is certified through the National Strength and Conditioning Association (NSCA) as a NSCA-Certified Personal Trainer® (NSCA-CPT®) and Certified Strength and Conditioning Specialist® (CSCS®) as well as United States of America Weightlifting (USAW) as a Sports Performance Coach. He has worked in corporate fitness at Chesapeake Energy Corporation for over 10 years and is currently the Supervisor and a personal trainer, working with individuals of all ages and abilities including youth, senior adults, and special needs population. He is passionate about helping others develop lifelong strategies they can use to make health and fitness a part of their daily life. He can be reached for questions or comments at bryan.jackson@chk.com.

PERSONAL TRAINING FOR THE SEDENTARY OFFICE WORKER



FIGURE 1. LESS OPTIMAL SITTING POSTURE



FIGURE 2. MORE OPTIMAL SITTING POSTURE



FIGURE 3. STABILITY BALL PLANK



FIGURE 4. STABILITY BALL PLANK ROLL-OUT



FIGURE 5. WALL SIT



FIGURE 6. OVERHEAD LUNGE



FIGURE 7. BAND ROW



FIGURE 8. FARMER'S WALK



FIGURE 9. FARMER'S WALK (UP THE STAIRS)

TABLE 1. WAYS TO INCREASE MOVEMENT AT WORK

Walk to co-worker's office/desk rather than discussing business through email
Take several bathroom breaks or walks to the water fountain
Spend more than half of lunch break standing or walking
Ask co-workers to have meetings "on the move"
Take the stairs rather than the elevator
Stand while working whenever possible
Take the long way back to the office/desk
Park farther away from the entrance to the building
Stand up frequently throughout the day
Make a challenging but realistic goal to reach a certain number of steps every day at work

PERSONAL TRAINING FOR THE SEDENTARY OFFICE WORKER

TABLE 2. SAMPLE 30-MIN WEEKLY WORKOUT PROGRAM

DAY	EXERCISE	SETS X REPS
Monday	Band horizontal rows	3 x 10
	Dumbbell bench presses	3 x 10
	Medicine ball overhead lunges	3 x 10 each leg
	Forearm planks	3 x 30 s
	Dumbbell single-arm rows	3 x 10 each arm
	Kettlebell Romanian deadlifts	3 x 10 each leg
	Stability ball knee drives	3 x 10 each leg
	Stationary bicycle sprints	10 x 15 s (hard) or 10 x 30 s (easy)
Wednesday	Dumbbell reverse flies	4 x 10
	Push-ups	4 x 15
	Wall sits	4 x 1 min
	Stability ball roll-outs	4 x 10
	Seated machine rows	4 x 10
	Dumbbell farmer's walks (up the stairs)	4 x 50 steps
	Renegade rows	4 x 10 each arm
	50-yard sprints	10 x 50 yards with slow walk back to recover
Friday	Singe-arm cable rows	3 x 10 each arm
	Dumbbell squat presses	3 x 10
	Hamstring curls machine	3 x 10
	Forearm planks	3 x 45 s
	Suspension trainer or bar inverted row	3 x 10
	Dumbbell lunges	3 x 10 each leg
	Push-up plank sideways crawls	3 x 20 yards down and back
	Rowing ergometer sprints	5 x 30 s (hard) or 5 x 1 min (easy)

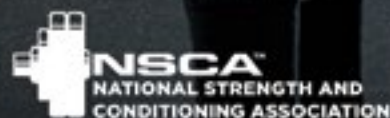
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COMMUNICATION—INTERVIEWS FROM EXPERTS IN PERSONAL TRAINING

CARMINE GRIECO, PHD, CSCS

Despite the myriad complex skills and knowledge that are necessary for the profession of personal training, success really boils down to just one thing: the ability to effectively communicate. Everything hinges upon this critical skill. Communication is a “skill” because, just like motor skills, communication is something that is learned and is trainable.

It may seem like an oversimplification to suggest that personal training success is dependent upon something as seemingly simple as communication. The word “communication” however, actually reflects a dizzying diversity of discreet skills. For example, nonverbal cues such as posture, body positioning, clothing, and facial expressions are powerfully important elements of communication. Willis and Todorov found that judgements of facial expressions are registered in as little as 100 milliseconds (1).

Realistically, personal trainers are not providing any information to their clients that they could not get elsewhere at a much cheaper rate and in a more convenient format. Why, then, is personal training a viable profession? It is the ability of a personal trainer to engage, motivate, and sometimes even entertain their client. In short, this is communication. For some personal trainers, this ability comes naturally, for others this is a process of learning and practicing the many skills that make up effective communication.

In this article, three outstanding fitness professionals share their thoughts and experiences on the importance of communication.

The expert panel includes:

- Lindsay Vastola (LV) is the editor of *Personal Fitness Professional* magazine and is the owner of Body Project Fitness and Lifestyle in Robbinsville, NJ.
- Heather Nutting (HN), NSCA-CPT, is the Group Exercise Director at Saco Sport and Fitness in Saco, ME.
- Shirley Archer (SA), NSCA-CPT, is the author of *Fitness 9 to 5: Easy Exercises for the Working Week* and a personal trainer in Los Angeles, CA.

HOW IMPORTANT DO YOU THINK COMMUNICATION SKILLS ARE TO YOUR SUCCESS AS A FITNESS PROFESSIONAL?

HN: “Communication skills have been crucial to my success. I have been told time and again by clients that they chose me after having watched me training other people. The reason was because they felt I was really paying attention to my other clients. Now that sounds almost absurd, right? Who else would I be paying attention to? Well, a fitness facility is a busy place with lots of people and distractions; it can be easy for trainers to lose their focus. If my client is working on the floor, I get on the floor. If they are seated on some equipment, I might get down on one knee. My eyes are on them. I communicate in every way possible that I am there for them.

Whether you are training an individual or a group, your communication skills are key to how you deliver your information and how you connect (or do not connect) with a client. You are always communicating, whether you mean to or not. The question is, what is it you are communicating? Are you drawing them in or pushing them away? Imagine you are having a horrendous day and someone cuts you off as you are pulling into the fitness center, so you blare your horn and scream a few choice words out to the offender. Then 10 min later you sit down with your first client of the day and realize you are face to face with the same person from the parking lot. What have you communicated to that person? Will this client be open to a connection now? Clients need to feel comfortable with the person they work with, and in this case, you might not get a second chance to leave a good impression. My advice is to remember that you are always communicating something.

A fitness professional needs to set the stage so that clear communication can flow both ways. The trainer needs information from the client to be able to determine the best plan to reach their goals, and then the trainer needs to share the plan with the client. The trainer needs to be a great listener and the client needs to know they are being listened to. This builds trust in the trainer/client relationship. Communicate that you are listening by remaining focused on them, nodding in understanding, asking clarifying questions or sometimes even restating what you have

heard. Fitness training is a challenge for most people, but if they have someone they enjoy being with and trust, it makes the process much more manageable.”

LV: “I think in many ways communication is a far more important skill than your training skills. You have to be really intuitive in the way that you communicate and cue your clientele. It is about finding your voice. Communication is something that is practiced. Invest in a speech coach and listen to yourself talk. Certainly it is going to impact how your client receives the information you are providing. I think one of the best things I have ever done is invest in a speech coach. It was really incredible how that impacted my sense of self-awareness. From a client’s standpoint, obviously being really mindful of the words that you use is really significant. How you paint the picture in the other person’s mind is very important. The word ‘modification’ for example, connotes to a client that they are not fit enough and we need to change things. The word ‘progression,’ however, has a totally different feel to it. It suggests that the exercise is changed just for them and it is more inclusive. It is important to be thoughtful with your words.”

WHAT LEVEL OF IMPORTANCE DO YOU GIVE TO NONVERBAL COMMUNICATION?

HN: “Nonverbal communication is a huge part of the package. Everyone has had an experience speaking with someone who is saying all of the ‘right things,’ but the nonverbal communication was saying just the opposite. For example, saying ‘I am here to support your success,’ while they are standing with their arms crossed and looking at people on the other side of the room. You communicate with your posture and your body position. For example, are you leaning in or away? Sitting or standing? Arms open or closed? Are you close enough to the client without invading their personal space?

You communicate with your face. Are you smiling sincerely? Is your facial expression appropriate? Are you engaged or are your eyes glazed over? You communicate with your voice. What is the tone of your voice? I often hear people training older adults and using a condescending tone frequently.

Another consideration is what the trainer is wearing. Are you communicating that you are a fitness professional and that you take your role seriously, or do you look like you are headed to get a workout yourself? Is your appearance intimidating? Also, showing too much skin can be off-putting.

Trainers have to read the client’s nonverbal communication as well. Sometimes when asking a client how they are doing, they verbally say they are ‘fine,’ but you can see by their facial expression, body language, or tone of voice that they are not fine. You might be able to read from their hesitation that there is more to the story.”

LV: “I think even more important than verbal communication is nonverbal communication. The nonverbal aspects such as the way you stand, the way you present your authority, the delivery, and being really purposeful in the way you pause in a conversation are all really important factors. For example, do you say the same phrases over and over again? Are you even aware of that? It is best to be hyperaware of who you are speaking to and bring emotional intelligence to your communication.

I was watching one of our new ‘green’ trainers as she was going through one of her fist sessions and I noticed that she was constantly leaning to one side. Physically, this is cueing to the client that you are there in body, but not really present. It feels uncomfortable to stand tall if you have not practiced it. When you stand by a client and you are cueing you should keep your weight balanced. This is an authoritative stance. After the session, I would then solicit feedback from the clients. After just a few coaching tips from me it was amazing to watch her progression over the first few sessions. Now she seems really engaged and focused and now she has more credibility with the clients.”

WHAT ARE SOME OF THE MORE IMPORTANT QUALITIES THAT EXEMPLIFY GREAT COMMUNICATION OR A GREAT COMMUNICATOR?

SA: “Clarity. Great writing or speaking is the result of clear thinking. To write about or explain something, you need to understand it well and learn to explain it in terms that your audience understands, not your terms. That results from doing your research and practicing how to present information. For example, it does not help your client to tell them to activate their “serratus anterior” or to supinate their hand if they have no idea what that means. You understand it, but you have not communicated anything meaningful to your client.”

HN: “A great communicator understands that communication is made through much more than just the words you say. The nonverbal communication is equally important.”

LV: “A great communicator is somebody who is very aware and thoughtful about what they are going to say. It is authentic and is not forced. They also have some variety in the way that they speak, so it is not monotonous. Also, you can see it in the way they carry themselves, especially with eye contact. The best communicators tend to be the best listeners and able to read people’s nonverbal cues. That is where emotional intelligence becomes important, the ability to read an audience and understand when they are or are not engaged.”

HOW HAVE YOU INCORPORATED MASS COMMUNICATION INTO YOUR PERSONAL TRAINING BUSINESS (E.G., WRITING, PUBLIC SPEAKING, AND OTHER TYPES OF LARGE-SCALE COMMUNICATION)?

SA: “The practice of good communication is my professional and personal passion. Since childhood, I have loved gathering information and sharing it with others for education and entertainment. [I have honed these skills as an editor of my middle school paper and yearbook, an editor of my high school yearbook, and eventually as a professional journalist, columnist, book author, and blogger.]

I began writing articles for professional fitness magazines on topics that I thought needed more attention fairly early in my fitness career. I used my research and writing skills from my education and prior work experience to share information with my peers, which enhanced my reputation as a master trainer and as a fitness industry leader. I wrote for consumer publications and as my reputation as an industry expert grew, I was often sought out by media outlets to be interviewed for my expertise. I have been interviewed by many top-tier publications including *The Washington Post*, *USA Today*, *Forbes*, *Shape*, and high profile

websites such as CNN.com, Marketwatch.com, Fitbie.com, WebMD.com, and HuffingtonPost.com.

Additionally, I did public speaking in my community wherever I was invited, including the local chamber of commerce, older adult communities, professional groups, and other corporations. This led to my making a concentrated effort to improve my public speaking skills so that I could offer keynotes, as well as educational speeches on fitness and wellness topics. I took classes on public speaking and joined Toastmasters International.

My visibility throughout the community and in the media increased my reputation as an expert and soon I was approached by a book agent to write my first book. One led to another and now I have authored or coauthored 15 titles. These books have been translated into several languages and are now sold throughout North America, Europe, Asia, New Zealand, and Australia. At this point, I have written over 600 magazine articles and continue to write on a monthly basis, including being a contributing editor for *IDEA Fitness Journal*.

I am now working to translate this expertise into success with social media. I maintain multiple Facebook pages and have Twitter, Instagram, Pinterest, and Tumblr accounts on which I share articles and photos and continue my passion for communication.

Each opportunity—such as writing one magazine article—has led to others. Then, it snowballed; I am now regularly featured in the news as journalists contact me for interviews and I have been appointed a media spokesperson for the American Council on Exercise and IDEA Health and Fitness Association. I have been approached by companies to represent their brands as a spokesperson. Clients are attracted to me as my credibility is validated by my media presence. I have been able to get books published and sold internationally. And, I have been invited to speak all over the world. I think my emphasis on communications throughout my career is the basis for my professional success combined with my hard work and passion for excellence.”

DO YOU HAVE ANY COMMUNICATION PRINCIPLES THAT GUIDE YOU?

SA: “Listen. To communicate well with others you need to genuinely listen to what each person is communicating to you. And, you need to make an effort not to interpret what they are saying from your point of view. Instead, try to be empathetic. Try to imagine what it is like to walk in their shoes and to see through their eyes. So often, people are in a rush and they feel unrecognized and unheard.

To communicate well, listen, observe, and try not to judge. When I train clients, I try to understand their lifestyle, their concerns, and to design a training plan that speaks to their needs and concerns in a way that works for their life, not the life that I think that they should lead or the goals that I think that they should have. That does not mean there is not a role for professional education and

guidance. I educate all the time, but at the same time, I let people be who they are and make programs that fit them, rather than trying to make them fit a preconceived idea of a program.

Follow your passion; I never wrote anything, gave a speech, or led a workshop simply for the money. I always did it from a place of passion fueled by my desire to provide valid information to help others in an area cluttered with so much misinformation. So, if I were to boil that down to a principle, it would be to write and talk about what you genuinely care about. People can feel authenticity.”

LV: “Simplicity is the ultimate form of sophistication. My business has really been focused on simplicity. Sometimes the most powerful way to communicate is to keep things simple. I really think this is a great reminder for me. At the end of the day people want to take away a simple concept. When I am communicating I always ask ‘what is in it for them?’ What are they going to get out of this?”

DO YOU HAVE ANY OTHER COMMUNICATION TIPS THAT YOU WOULD LIKE TO PASS ON TO OTHER STRENGTH AND CONDITIONING PROFESSIONALS?

SA: “Try to incorporate one communication tip [from the article] that you are not already doing in your business and see if it makes a difference. The proof will be in the practice.”

LV: “Listen, just listen. Listen to the business. When I started out, I had these preconceived notions of what marketing is, for example. I had a business coach once that told me to listen to my business. Then you can tailor the way you communicate. That is one thing that really moved the needle for me. Seek out people who will tell you how to be better. Hire coaches or find mentors; people who can help you speed up that process for you. Read voraciously and always be learning.”

REFERENCES

1. Willis, J, and Todorov, A. First impressions: Making up your mind after a 100-ms exposure to a face. *Psychological Science* 17(7): 592-598, 2006.

ABOUT THE AUTHOR

A personal trainer with over 15 years of experience, Carmine Grieco recently made the transition from personal trainer to college professor. Recently hired as an Assistant Professor of Exercise Science at Glenville State College, Grieco received his Doctorate degree in Human Movement Sciences from Old Dominion University in 2012. Grieco recently accepted a position at Colorado Mesa University. He is the National Strength and Conditioning Association (NSCA) West Virginia State Director and is passionate about the profession of fitness. Grieco is now focusing his time and energy on training the next generation of fitness professionals.

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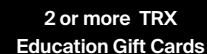


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