

Personal trainer demographics, current practice trends and common trainee injuries

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Abstract

Increasing emphasis on maintaining a healthy lifestyle has led many individuals to seek advice on exercise from personal trainers. There are few studies to date that evaluate personal trainer education, practice trends, and injuries they have seen while training clients. A survey was distributed to personal trainers using Survey Monkey® (Palo Alto, CA, USA) with 605 personal trainers accessing the survey. An exercise related bachelor's degree was held by 64.2% of survey participants and a certification in personal training by 89.0%. The most common personal trainer certifications were from American College of Sports Medicine (59.2%) and National Strength and Conditioning Association (28.9%). Only 2.9% of all personal trainers surveyed had no exercise-related bachelor's degree and no personal trainer certification. The most common injuries seen by personal trainers during sessions were lumbar muscle strain (10.7%), rotator cuff tear/tenosynovitis (8.9%), shin splints (8.1%), ankle sprain (7.5%), and cervical muscle strain (7.4%). There is variability in the practices between different personal trainers when analyzing differences in collegiate education, personal trainer certifications, and strength and conditioning certifications. The clinical implication of the differences in practices is unknown as to the impact on injuries or exercise prescription effectiveness.

Introduction

Regular physical activity provides substantial health benefits. The current recommendations encourage activity on most or all days of the week.^{1,2} Without proper education on how to exercise, it is possible to become injured. From 1990 to 1997, United States Emergency Departments saw an estimated 970,801 injuries related to weight training.³ Resistance training is on the rise in the United States and

older individuals are becoming involved. The most common injury mechanism requiring an emergency department visit was dropped weights.³ Over 90% of the injuries happened with free weights.³ When examining sex differences in exercise females had more accidental types of injuries, while males had more exertional related injuries.⁴ Hiring a personal trainer may be a helpful way of learning how to properly exercise and how to prevent common exercise associated injuries.⁵

Personal trainers help with the design and implementation of safe and effective resistance training and cardiovascular exercise programs. According to the National Strength and Conditioning Association (NSCA)'s Scope of Practice for their certified personal trainer, personal trainers are professionals that use an *individualized approach, assess, motivate, educate and train clients regarding their health and fitness needs. They design safe and effective exercise programs, provide the guidance to help clients achieve their personal health/fitness goals and respond appropriately in emergency situation.*⁵ Supervised training sessions have been found to lead to greater increases in maximal strength gains compared to unsupervised training sessions.⁶ One-on-one personal training has also been found to be an effective way to increase the amount of physical activity of an individual by changing attitudes towards exercise.⁷

Personal trainers typically either have a collegiate type degree and/or a certification.⁵ Some certification programs are extremely rigorous and require course pre-requisites, while others just require paying a fee and taking an exam.⁵ At the current time, the industry remains mostly unregulated and health clubs can hire staff regardless of certification or education level.⁵ Some in the exercise field think that personal trainers should have a collegiate degree and a rigorous certification.⁸ A study of personal trainer knowledge by Malek showed that personal trainers with a bachelor's degree and a certification by the American College of Sports Medicine (ACSM) or the NSCA performed better on a personal trainer related knowledge test than other personal trainers.⁸ These personal trainer certifications exist to show educational standards met to reassure clients and club managers of adequate knowledge and training.⁹ To the public, it may be difficult to determine which path a personal trainer has taken to become employed and if they are hiring a qualified individual to train them.

A survey of health clubs in Southeastern Massachusetts in 2006 revealed 80% of clubs required a certification and only 10% required a bachelor's degree.⁹ This study showed that in that specific area of the country, an NSCA certification was preferred by health clubs.⁹ Personal trainers in this survey made around

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\$50.00 per hour and only 1% of health clubs required personal trainers to have their own liability insurance.⁹

The rise in higher intensity training types including high intensity interval training (HIIT) and high intensity power training (HIPT) have incorporated more complex exercises at higher intensities into the exercise routines of the general population with the popularization of P90X®, Insanity®, and CrossFit®, a form of HIPT training, has been found to increase VO₂ max and body composition.¹⁰ Similar high intensity programs done in the military have shown no increase in injury.¹¹ Individuals are devoutly following these types of higher intensity exercise programs.¹²

Using machines during exercise is perceived as being safer than free weights, but there may be an over sense of security with machines potentially leading to more overexertion type injuries.³ The injuries seen with strongman athletes and *odd shaped objects* has led to the idea that strongman style resistance training programs can have an increased risk of injury over traditional exercises.¹³ Personal trainers choose exercises and make programs to prevent injuries and improve health.

Personal trainers have a wide variety of backgrounds with some having a college degree in an exercise related field, some having taken a certification course, and some having experience only. Employers can have a minimal training requirement, but not all do. Some personal trainers also own their own studios or train participants at other locations including a client's home. To date there is little

known about the average educational training of a certified personal trainer and common fitness practices.

Materials and Methods

The survey was created using Survey Monkey® (Palo Alto, CA). The survey, application and recruitment letter were presented to the Institutional Review Board at Rhode Island Hospital and the project was granted exempt status.

A total of 6175 personal trainer email addresses were collected from individual gym websites and forums. The survey and recruitment letter were distributed by finding any instructor email addresses or the gym email address on the individual gym websites and contacting through email. The recruitment letter was also posted on social media and on health and fitness forums with a link to the survey. The recruitment letter asked instructors or the gym to distribute the survey to all other personal trainers they knew. The survey was designed to be filled out only by individuals who identified themselves as personal trainers as specified in the recruitment letter.

Survey data was collected from February 2014 to May 2014. We did not mandate that survey participants answer each question. Statistical analysis was performed using Chi-Square test with a P-value set to less than 0.05 as significant. Analysis was performed to examine the effect of a bachelor's degree, master's degree, personal trainer certification type, and type of strength and conditioning certification on a personal trainer's practice.

Results

There were a total 605 individuals that accessed the survey. It is unknown how many individuals saw the recruitment letter and who actually received the email. Three participants

who accessed the survey did not answer any questions.

The respondents were 54.5% female and 45.5% male. The average personal trainer age was 39.8 ± 12.7 years. Personal trainers have been working for 13.4 ± 10.0 years and work 32.4 ± 16.3 hours per week. Personal training is the primary employment for 84.03% of the study participants (Table 1).

Each week 50.6 ± 210.9 people are taught per personal trainer. The average number of instructors per class or session is 1.1 ± 1.4 for a class/session size of 7.8 ± 9.5 participants (Table 1).

Personal trainers reported having a bachelor's degree in an exercise related field by 64.2% of survey participants with 41.6% having a master's degree as well. Only 2.9% ($n=16$) of all personal trainers had no bachelor's degree and no personal trainer certification. Only 3.1% were also certified as a CrossFit® instructor. A personal training certification was held by 89.0% of survey participants with the most common being from the ACSM (59.1%), NSCA (28.9%), National Academy of Sports Medicine (NASM) (12.4%), and American Council on Exercise (ACE) (10.2%) (Table 2). Personal trainers reported that 40.9% also had a strength and conditioning certification with 36.1% having a Certified Strength and Conditioning Specialist (CSCS) from the NSCA and 9.3% having a USA weightlifting certification.

Olympic weightlifting is taught by 27.6% of instructors. One-repetition maximal lifts for snatch were performed by 3.9% of athletes and 10.1% of athletes for clean and jerk or hang cleans.

Kettlebells were used by 70.4% of personal trainers with 73.5% reporting one-on-one training to ensure proper form. The most common way for a personal trainer to learn how to use kettlebells was self-taught (40.5%) followed by a course (23.4%). *I do not know how to use kettlebells* was reported by 10.8% of personal trainers.

The use of *odd-shaped objects* as part of an exercise program was reported by 27.2% of personal trainers. Olympic weightlifting platforms

or Olympic style weightlifting rubberized bumper mats were used by 30.5% of personal trainers. Olympic style weightlifting shoes are utilized by 9.3% of personal trainers. Barefoot lifting was allowed by 23.8% of personal trainers and *toe* shoes were allowed by 47.6% of personal trainers.

The typical exercise program for personal trainers responding to this survey was 33% dumbbells/barbells, 24% cardio, 12% machines, 12% resistance bands, 11% kettlebells, 7% Olympic weightlifting, and 22% other. Only 2.4% of personal trainers performed no stretching. The most common form of stretching was static (80.0%), then dynamic (75.6%), and proprioceptive neuromuscular facilitation (55.2%).

Personal trainers with a bachelor's degree (Table 3) taught more Olympic weightlifting than those without (31.3% vs. 20.0%, $P=0.005$) and also used more Olympic weightlifting platforms than those without a bachelor's degree (75.7% vs. 61.7%, $P=0.003$). A master's degree level personal trainer uses less kettlebells (36.0% vs. 51.0%, $P=0.002$) and does less one-on-one kettlebell teaching (34.4% vs. 53.6%, $P=0.0002$) than personal trainers without a master's degree. There were no other statistical differences between collegiate education background in exercise and non-collegiate education.

Olympic weightlifting (Table 4) in practice is different amongst the top four personal trainer certifications (ACE, ACSM, NASM, and NSCA). NSCA professionals (52.0%) performed more Olympic weightlifting than no certification (34.5%, $P=0.035$), ACE (13.5%, $P=0.0001$), ACSM (16.7%, $P=0.0001$), and NASM (30.8%, $P=0.007$). ACE ($P=0.001$) and ACSM ($P=0.003$) taught less Olympic weightlifting than no certification. NASM taught more Olympic weightlifting than ACE ($P=0.047$) and ACSM ($P=0.01$). There was no statistical difference between ACE and ACSM or NASM and having no certification.

Allowing clients to perform 1-RM clean and jerk/hang clean was increased amount NSCA (14.9%) professionals compared to ACE ($P=0.02$), ACSM ($P=0.002$), and NASM

Table 1. Demographics of personal trainers.

Question	Total	Responses	SD
What is your gender? (F/M)	598	326/272	54.5/45.5%
What is your age?	602	39.8	12.7
How many years have you been working in the exercise field?	601	13.4	10.0
How many hours per week do you work at your exercise related employment?	601	32.4	16.3
Is your primary employment in an exercise related field? (Yes/no)	601	505/96	84.0/16.00%
Approximately how many people do you teach exercise to each week?	596	50.6	210.9
What is the average number of members per class/session you teach?	552	7.8	9.5
What is the average number of instructors per class?	544	1.1	1.4

($P=0.02$). No ACE professional (0%) reported allowing clients to 1-RM on this exercise, this was statistically lower than those with no certification ($P=0.04$). There were no statistical differences in between ACE, ACSM, and NASM. Allowing clients to perform 1-RM snatch revealed no statistically significant difference between the types of personal trainer certification. No certification had no statistically significant difference when compared to each of the types of personal trainer certification.

Kettlebells are used more commonly in NASM (82.8%) and NSCA (78.5%) trained individuals compared to no certification ($P=0.003$). NASM used kettlebells more than ACSM professionals ($P=0.047$). Kettlebell one-on-one teaching was done more by the ACSM (78.8%), NASM (85.5%), and NSCA (81.1%) compared to no certification ($P=0.006$, $P=0.004$, $P=0.004$).

Odd-shaped objects were used statistically less by ACSM (20.2%) professionals compared to NASM (40.3%, $P=0.001$) and NSCA (40.1%, $P=0.001$) professionals.

Olympic weightlifting platforms and rubberized mats were used more by NASM (40.3%), NSCA (48.3%), and no certification (36.0%) when each was compared to ACE (16.0%) and ACSM (20.7%). There were no statistically significant differences between ACE and ACSM (16%, 20.7%, $P=0.56$). There was no statistically significant difference between no certification, NASM, and NSCA.

Olympic weightlifting shoes are used more by the NSCA (15.6%) professionals compared to ACE (2.0%, $P=0.02$) and ACSM (4.8%,

Table 2. Personal trainer certification [557 answers: 496 yes (89%); 61 no (11%)].

American Council on Exercise	57 (10.2%)
American College of Sports Medicine	329 (59.1%)
Aerobics and Fitness Association of America	33 (5.9%)
American Fitness Professionals and Associated	2 (0.4%)
International Sports Sciences Association	3 (0.5%)
National Academy of Sports Medicine	69 (12.4%)
National Exercise and Sports Trainers Association	5 (0.9%)
National Council for Certified Personal Trainers	3 (0.5%)
National Strength and Conditioning Association	161 (28.9%)
Other	93 (16.7%)
World Instructor Training School	3 (0.5%)
National Institute of Health Sciences Personal Trainer	1 (0.2%)
YMCA Personal Training Cert	3 (0.5%)
American Senior Fitness Association	1 (0.2%)
AAAI/ISMA Fitness Certification	1 (0.2%)
National Personal Trainer Institute	3 (0.5%)
Australian Fitness Network	1 (0.2%)
Asian Academy for Sports and Fitness Professionals	1 (0.2%)
Action Personal training	1 (0.2%)
TRX	5 (0.9%)
Tudor Bompa Institute	1 (0.2%)
American Aerobics Association International	1 (0.2%)
Resistance Training Specialist	1 (0.2%)
US Army Master Fitness Trainer	1 (0.2%)
Dragon Door	3 (0.5%)
Titleist Performance Institute Golf Fitness Instructor	2 (0.4%)
Gray Institute Certification in Applied Functional Science	1 (0.2%)
Z-Health	16 (2.9%)
Nike Sparq	1 (0.2%)
DNS Certified Personal Trainer	1 (0.2%)
Poliquin Personal Training	1 (0.2%)
Personal Training Academy Global	1 (0.2%)
National Council On Strength and Fitness	1 (0.2%)
Hardstyle Kettlebell Certification	1 (0.2%)
International Youth Conditioning Association	2 (0.4%)
Functional Movement Systems	2 (0.4%)
National Exercise Trainers Association	1 (0.2%)
Cooper Institute Personal Training	2 (0.4%)

Table 3. Collegiate education and personal trainer practice trends.

		Bachelor's Degree			Master's Degree		
		Yes, %	No, %	P	Yes, %	No, %	P
Olympic lifting performed	Yes	31.3	20.0	0.005*	40.7	41.2	0.9
	No	68.7	80.0		59.3	58.8	
Hang Clean/Clean and Jerk Max	Yes	80.5	69.5	0.14	41.5	40.8	0.9
	No	19.5	30.5		58.5	59.2	
Snatch Max	Yes	75.0	70.6	0.71	31.3	41.1	0.4
	No	25.0	29.4		68.8	58.9	
Kettlebell use	Yes	64.9	65.1	0.97	36.0	51.0	0.002*
	No	35.1	34.9		64.0	49.0	
Kettlebell one-on-one	Yes	64.9	69.1	0.39	34.4	53.6	0.0002*
	No	35.1	30.9		65.6	46.4	
Odd-shaped objects	Yes	67.9	64.6	0.49	39.7	41.3	0.75
	No	32.1	35.4		60.3	58.7	
Platform use	Yes	75.7	61.7	0.003*	44.6	37.6	0.15
	No	24.3	38.3		55.4	62.4	
Olympic shoe use	Yes	70.5	65.5	0.51	38.6	39.6	0.9
	No	29.5	34.5		61.4	60.4	
Barefoot lifting	Yes	64.0	65.3	0.81	31.9	41.9	0.06
	No	36.0	34.7		68.1	58.1	
Toe shoe	Yes	67.0	63.7	0.45	39.9	40.5	0.53
	No	33.0	36.3		60.1	59.5	

*P-values are considered significant.

P=0.0004). ACSM used less Olympic weightlifting shoes than NASM (13.3%, P=0.03) and no certification (14.0%, P=0.03).

Barefoot lifting is allowed more by NSCA (35.4%) and NASM (37.1%) professionals than those from ACE (16.3%) and ACSM (18.6%). There was no statistically significant difference between no certification and any of the personal trainer certifications.

Toe shoe use showed no statistically significant difference between no certification and any of the four common personal trainer certifications. Toe shoes were allowed by more NASM (66.7%) than ACSM (42.9%, P=0.001) and NSCA (50.4%, P=0.049).

Personal trainers who had either a CSCS or a USA weightlifting certification had statistically significant differences in Olympic weightlifting, 1-RM snatch or clean and

jerk/hang clean, *odd-shaped objects*, Olympic platform use, Olympic weightlifting shoe use, barefoot lifting, and allowing *toe* shoes compared to those without a strength and condi-

tioning certification. CSCS professionals had a statistically significant difference in kettlebell use (76.4%) and one-on-one teaching (80.5%) compared to non-strength and conditioning

Table 4. Personal trainer certification and Olympic weightlifting performed.

	None	ACE	ACSM	NASM	NSCA
Yes, %	34.5	13.5	16.7	30.8	52.0
No, %	65.5	86.5	83.3	69.2	48.0
None, P-value		0.001*	0.003*	0.81	0.035*
ACE, P-value			0.71	0.047*	0.0001*
ACSM, P-value				0.01*	0.0001*
NASM, P-value					0.007*
NSCA, P-value					

ACE, American Council on Exercise; ACSM, American College of Sports Medicine; NASM, National Academy of Sports Medicine; NSCA, National Strength and Conditioning Association. *P-values are considered significant.

Table 5. Injuries seen by personal trainers (total 4975).

Injuries	N.	Rank	%	Injuries	N.	Rank	%
Head/neck injuries (626; 12.5%)							
Concussion	47	20	0.9	Stroke	9	51	0.2
Intracranial bleeding	1	55	0.02	Cervical muscle strain	367	5	7.4
Cervical fracture	88	16	1.8	Cervical disc herniation	114	14	2.3
Upper extremity injuries (1117; 22.5%)							
Rotator cuff tear/tendonitis	445	2	8.9	Shoulder dislocation	29	30	0.6
Shoulder labrum tear	48	19	1.0	Proximal biceps tear	15	39	0.3
Pectoralis major tear	3	53	0.1	Shoulder/AC joint separation	40	22	0.8
Fracture (clavicle/proximal humerus/scapula)	18	38	0.4	Distal biceps tear	14	45	0.3
Triceps tear	3	53	0.1	Fracture (elbow)	15	39	0.3
Lateral epicondylitis (tennis elbow)	212	9	4.3	Medial epicondylitis (golfer's elbow)	125	13	2.5
Ulnar collateral (medial) ligament tear	5	52	0.1	Scapholunate ligament tear	1	55	0.02
Forearm/wrist tendonitis	82	17	1.7	Wrist fracture	22	35	0.4
Finger fracture	25	34	0.5	Finger dislocation	15	39	0.3
Lumbar spine injuries (724; 14.6%)							
Lumbar fracture	11	49	0.2	Lumbar muscle strain	531	1	10.7
Lumbar disc herniation	182	10	3.7				
Lower extremity injuries (2508; 50.4%)							
Hamstring strain	32	28	0.6	Tibial stress fracture	26	32	0.5
Hamstring tear (requiring surgery)	12	47	0.2	Hip labrum tear	37	23	0.7
Sports hernia	57	18	1.2	Hip/femur fracture	15	39	0.3
Hip dislocation	11	49	0.2	Hip flexor/quadriceps injury	221	8	4.4
Meniscus tear	147	11	3.0	ACL tear	113	15	2.3
MCL tear/sprain	47	20	0.9	PCL tear	35	25	0.7
Lateral collateral or posterolateral corner injury	19	37	0.4	Quadriceps tendon tear (requiring surgery)	15	39	0.3
Patellar tendon tear (requiring surgery)	15	39	0.3	Patellar tendonitis	248	7	5.0
Patellofemoral pain syndrome/anterior knee pain	316	6	6.4	Knee fracture	13	46	0.3
Patellar dislocation	21	36	0.4	Knee dislocation	12	47	0.2
Ankle sprain	373	4	7.5	Lisfranc/foot sprain	35	25	0.7
Peroneal tendon injury	27	31	0.5	Achilles rupture	35	25	0.7
Achilles tendonitis	128	12	2.6	Ankle fracture	32	28	0.6
Tibia fracture	26	32	0.5	Foot/toe fracture	37	23	0.7
Shin splints	403	3	8.1				

certified individuals ($P=0.04$, $P=0.014$), but there was no statistically significant difference between CSCS and USA weightlifting certified individuals in kettlebell use or one-on-one teaching.

A total of 4975 injuries were reported by personal trainers responding to the survey. Lower extremity injuries made up 50.4% of all injuries reported, while upper extremity injuries made up 22.4%. The most common injuries seen by personal trainers during sessions were lumbar muscle strain ($n=531$, 10.7%), rotator cuff tear/tenosynovitis ($n=445$, 8.9%), shin splints ($n=403$, 8.1%), ankle sprain ($n=373$, 7.5%), and cervical muscle strain ($n=367$, 7.4%) (Table 5).

Discussion

Personal trainer sessions can vary from one-on-one training, couples training, to group exercise sessions. Our survey showed that most personal trainers teach some type of group exercise class to give the average number of participants per session 7.8 ± 9.5 . There is evidence that team activities have more advantages to individual exercise-focused activities with regard to continued adherence to exercise.¹⁴

The personal trainers surveyed were experienced with 13.4 ± 10.0 years of work experience. The number of years of experience suggests that personal trainers in the survey have been practicing through various waves of different popular exercise programs. Of personal trainers, 84.0% surveyed reported that their primary employment was exercise related. The survey also suggests that more personal trainers are female than male (54.5 vs. 45.5%).

The educational training required to be a personal trainer is variable. National Collegiate Athletic Association (NCAA) studies have suggested that NCAA strength and conditioning coaches at the division I level have a strength and conditioning certifications and it be more desirable to have a master's degree.¹⁵⁻¹⁷ Personal trainers in our study reported 64.2% had an exercise related bachelor's degree and 41.6% had an exercise-related master's degree. Of personal trainers, 89.0% held a personal trainer certification with the most common in our study being from ACSM (59.1%) and NSCA (28.9%). The certifications held by the ACSM and NSCA in conjunction with a bachelor's degree previously were shown lead to superior knowledge in surveyed personal trainers.⁸ When designing the survey, we listed nine common certifying agencies and an *other* section as there is no current federal regulation on what a personal trainer certification requires. Some personal trainers listed they were certified in TRX® ($n=5$, 0.9%) or

other very specialized forms of training that historically are not thought of as *personal training certifications*, however since the personal trainers surveyed thought they were, we decided to include them as *other* and constitute this as *certified*. Only 2.9% of all personal trainers had no bachelor's degree and no personal trainer certification, which suggests that either level of training is generally required for employment. Advanced certification in strength and conditioning was reported by 40.9% of personal trainers. Only 3.1% of personal trainers surveyed also have any type of CrossFit® instructor certification. At the current time there is no standard educational path required to become a personal trainer. There is also variability within the certification requirements for varying certifying agencies or university programs. In addition, different gyms vary in the training and certification requirements for employment.

Interestingly, 11.0% of personal trainers in our survey did not have any personal trainer certification and 35.8% do not have a bachelor's degree in an exercise related field. Having a bachelor's degree was statistically significant for higher Olympic weightlifting and platform use than those without a bachelor's degree. This suggests that this level of collegiate education prepares an individual to feel more comfortable teaching Olympic weightlifting. A master's degree had no significant difference on if a personal trainer taught Olympic weightlifting. A master's degree did significantly lower kettlebell use and one-on-one teaching in kettlebells. The significance of this is unknown.

Personal trainers with an NSCA personal trainer certification taught more Olympic weightlifting than uncertified personal trainers, ACE, ACSM, or NASM. NSCA personal training professionals also appear more comfortable with allowing 1-RM clean and jerk/hang cleans, but all personal trainers generally did not perform 1-RM on snatch. Uncertified personal trainers reported less one-on-one training with kettlebells at a statistically significant level compared to ACSM, NASM, and NSCA professionals, although uncertified professionals did report the lowest use of kettlebells.

Having a strength and conditioning certification from the NSCA (CSCS) or USA weightlifting revealed higher use of Olympic weightlifting, 1-RM max, *odd shaped objects* than those not certified, and USA weightlifting certified professionals used more Olympic weightlifting than CSCS professionals. This likely has to do with the knowledge required to obtain either the CSCS or the USA weightlifting requires more familiarity with Olympic weightlifting techniques. USA weightlifting certification likely has more emphasis on Olympic weightlifting and therefore these pro-

fessionals do more Olympic weightlifting than CSCS professionals. This could also be self-selected that professionals who want to teach Olympic weightlifting seek out a USA weightlifting certification more as well.

Stretching is performed by the majority of personal trainers, with only 2.4% reporting not having participants do any stretching. Personal trainers most commonly performed static stretching (80.0%) or dynamic stretching (75.6%). The importance of stretching has been evaluated in the literature,¹⁸⁻²¹ but there is no general consensus on what the best stretching routine is to improve flexibility and performance. Based on the idea that only 2.4% of personal trainers did no stretching, personal trainers clearly feel that there is an importance in performing some type of stretching with clients.

The typical programming of a personal trainer is 33% dumbbell/barbell resistance training, 24% cardiovascular endurance exercises, 12% resistance bands, 12% exercise machines, 11% kettlebells, 7% Olympic weightlifting, and 22% other. This information shows that personal trainers use a variety of different techniques with clients and since we know that 29.6% of personal trainers do not use kettlebells and 72.4% of personal trainers teach no Olympic weightlifting, there must be a wide variety of different programs done in gyms and studios around the United States. There is not one best way to program exercise and therefore we expect there to be variability amongst personal trainers who have different backgrounds in exercise training. We are reporting that kettlebells are used more NASM and NSCA personal training certified professionals than uncertified personal trainers and that CSCS professionals also perform more kettlebell use than non-strength and conditioning certified individuals. Olympic weightlifting is more likely to be performed by NSCA personal trainers, CSCS professionals and those with a USA weightlifting certification. Our data shows the 3.1% of personal trainers surveyed who identified themselves specifically as personal trainers also had some advanced standardized training as a CrossFit® instructor. CrossFit® is a type of HIPT that has been shown to have improvements in VO2 Max and body composition,¹⁰ while showing to have a strong adherence rate.²² The only study to calculate an injury rate to date of CrossFit® participants calculated a rate of 3.1 injuries per 1000 hours,²³ which is similar to the calculated injury rates of powerlifting (1 to 4.4 injuries per 1000 training hours,^{24,25} strongman athletes 5.5 ± 6.5 training injuries per 1000 hours,¹³ dancing 1.5-4 per 1000 hours, rowing 3.67 per 1000 hours, Australian competitive calisthenics 1.1 per 1000 training hours and boxing 2 per 1000 hours.²⁶⁻²⁹ Injury rates in contact sports have been quoted as 20.7 per

1000 training hours or 6.9 per 1000 hours for pro rugby, 16 per 1000 hours of practice/competition for American football, 14.3/1000 hours handball games, and 17.1/1000 hours soccer.³⁰⁻³⁴ Bodybuilding has been found to have 0.24 injuries per 1000 training hours.³⁵ The current literature suggests that HIPT is no more dangerous than other forms of weight training.

Kettlebell popularity has increased in the United States, although this type of training dates back to Russia in the 1700s.³⁶ In our study 70.4% of personal trainers report kettlebell use with clients. Research done on kettlebell training has shown improvements in vertical jump and half-squats with kettlebell swing training³⁷ and similar metabolic responses to equal duration of graded treadmill walking and running.^{36,38} Kettlebells are being used in rehabilitation³⁹ and when done correctly may improve lumbar pain while in others may irritate lumbar tissues.⁴⁰ There has been one case report with a wrist injury related to kettlebell use.⁴¹ Injuries to the wrist from kettlebells are thought to occur commonly with beginners due to direct impact over the wrist or due to off center handling. The most common way personal trainers learned how to use kettlebells in our study was *self-taught* and this raises the question of a possible lack of standardized technique, training, and exercises. There is no study to date that has evaluated the best way to learn or teach kettlebell exercises. Due to the increasing popularity of kettlebells in exercise programs, the authors are suggesting that professionals consider taking some type of formalized training or formalized kettlebell training be incorporated into collegiate education and/or certification classes to help learn proper techniques to keep their clients safe if professionals choose to teach with them.

Junkyard or strongman exercises or using *odd-shaped objects* have been adopted by 27.2% of personal trainers to use with clients. Using heavy, odd-sized and cumbersome everyday items in nontraditional movement patterns is referred to as *junkyard* training. Some common items are cement blocks, chairs, anchors, and motor vehicles. A study of *junkyard* training shows that there is a very high metabolic anaerobic demand during a motor vehicle push exercise.⁴² The popularity of this type of training is thought to have come about from the strongman competitions. A study of strongman injuries showed that in strongman specific athletes there were 5.5±6.5 training injuries per 1000 training hours with 1.6±1.5 training injuries per year per lifter.¹³ The most common injuries seen are to the lower back and shoulder with 68% being acute injuries and 47% being of *moderate severity*.¹³ Strongman athletes ranked the most dangerous exercise as the tire flip but the most common strongman injury was during the stone work or yolk walk.¹³ Around 25% of strongman thought poor

technique was the reason for developing an injury.¹³ Given the higher risk of using these types of exercises, personal trainers should be careful to teach proper form and restrict these exercises to individuals who need higher metabolic demand workouts and can demonstrate the athletic ability to safely perform these exercises. Advocates of barefoot running believe that it may result in fewer running related injuries due to different running mechanics.⁴³ Around 1/3 of runners surveyed were motivated to add either a minimalist shoe or try barefoot running to help with possible injury prevention.⁴³ The role of barefoot or minimalist *toe* shoes in weight training is not established but 23.8% of personal trainers allow athletes to lift barefooted and 47.6% allow athletes to lift with minimalist *toe* shoes. The Olympic weightlifting literature suggests that weightlifting shoes with an elevated heel are recommended for those with a forward trunk lean and to increase knee extensor activation.⁴⁴ With only 27.6% of personal trainers teaching Olympic weightlifting, it is understandable that Olympic weightlifting shoes are only used by 9.3% and platforms by only 30.5% of survey participants. USA weightlifting certified professionals used more Olympic weightlifting shoes than either CSCS professionals or non-strength and conditioning certified individuals. The authors suggest that personal trainers consider having their clients use stable based footwear and have a landing surface with shock absorbing properties such as an Olympic style platform or specialized rubberized mat if clients are to be performing high impact exercises including Olympic weightlifting or plyometrics.

The most common injuries seen by personal trainers during sessions were lumbar muscle strain, rotator cuff tear/tendonitis, shin splints, ankle sprain, and cervical muscle strain. Personal trainers reported a variety of head injuries, fractures, and tendon ruptures as well which tend to be more involved injuries. Ability to perform a bodyweight squat correctly may help professionals design a safe exercise program.⁴⁵ Anterior cruciate ligament (ACL) prevention programs have been effective with athletic populations as well.^{46,47} In the military population, ACL injuries are most common,⁴⁸ however in our survey, personal trainers saw 113 ACL injuries representing the 15th most common injury we evaluated for. Aside from performance gains and body composition changes, personal trainers are expected to prevent injuries. This can be a difficult task in a sedentary population or a population that has limited experience with exercise which is more likely the population seen by personal trainers especially if comparing to the military population, therefore a different set of injuries would be more common. In particular in working with a younger population,

Faigenbaum has written that lack of qualified instruction, poor exercise technique, and inappropriate training loads can explain at least some of the reported resistance training injuries in the youth.⁴⁹ Myer et al showed that children had more resistance training injuries from accidents that are probably preventable with increased supervision and stricter safety guidelines.⁵⁰ Lumbar muscle strains are common with activities of daily living and therefore it may be tough to determine if the personal trainer program was the reason for the injury. Rotator cuff tear risk also is known to increase with age.⁵¹ As more older individuals are exercising, we expect to see more rotator cuff tendonitis and tears amongst individuals who exercise.

A query of the United States weightlifting injuries showed that males had more sprains and strains, while females had more accidental injuries.⁴ Quatman and colleagues suggested that to reduce accidental injuries, an emphasis should be placed on safe equipment use, proper lifting technique, strict safety guidelines, and appropriate supervision.⁴ Appropriate supervision is exactly what a personal trainer is expected to provide an individual who is exercising. Literature of professional fitness athletes suggests that bodybuilding type workouts have less injuries per 1000 hours than powerlifting,²⁵ Olympic weightlifting,^{24,52,53} and strongman¹³ type workouts, but this has not been evaluated in the recreational athlete to date. Interestingly, the use of machines is perceived to be safer than free weights, but the over sense of security with machines can lead to a higher proportion of overexertion type injuries.³ Elastic or resistance bands have also been reported in the literature as causing injuries including a case of traumatic retinal detachment.⁵⁴ Previous literature from Raske and colleagues suggests that Olympic weightlifting (clean and jerk, snatch) leads to more lumbar and knee injuries, while powerlifting (bench press, deadlift, squat) exercises lead to more shoulder injuries.⁵² Kolber and colleagues suggested avoiding lateral deltoid raises and upright rows beyond 90 degrees can help decrease symptoms of rotator cuff disease.⁵⁵ No form of physical activity is completely without any risk of injury. The authors suggest correct form and safe lifting loads should be emphasized.

The number of individuals participating in weight training continues to increase and therefore so does the number of individuals at risk for injury.³ Injury data from the National Football League shows that most injuries occurring during training camp occur earlier on in training.⁵⁶ Earlier injuries when working with athletes or clients typically occur in less conditioned individuals. Overuse tendon injuries (*i.e.* rotator cuff tendonitis) and shin splints are conditions that can occur if individ-

uals are progressed to quickly. Older individuals also have a higher injury incidence.³ HIIT at 90% VO₂ max has been reported as a useful alternative to 70% steady state exercise.⁵⁷ HIIT training at the current time has not been well evaluated for which population of individuals it most benefits and if any are significant adverse effects. CrossFit® and HIPT literature suggests that it has clear benefits to VO₂ max and body composition¹⁰ and that males and females differ in their motivational variables for exercise.⁵⁸ Males had higher levels of performance related goals, while females have higher levels of exercise mastery goals.⁵⁸ High intensity training literature also suggests that participants are more likely to continue exercising this way compared to moderate aerobic type exercise.²² Nevaizer suggested that the rotator cuff's unfavorable position during some lifts can lead to a shoulder injury, and that proper lifting techniques and habits can potentially reduce the risk of injury.⁵⁹

Conclusions

To our knowledge, this is the first investigation into the training and backgrounds of personal trainers. Personal trainers have a variety of different personal trainer certifications and educational backgrounds and the significance of this from previous studies shows that personal trainer fitness related knowledge improves with a bachelor's degree and a more rigorous certification. Kettlebell use is common amongst personal trainers with the highest percentage of personal trainers reporting *self-taught* for how they learned how to use kettlebells. Olympic weightlifting is taught by 27.6% and *odd-shaped objects* are used by 27.2% of personal trainers. Personal trainers have variability in their exercise programs. The most common injuries seen by personal trainers during sessions were lumbar muscle strain, rotator cuff tear/tendonitis, shin splints, ankle sprain, and cervical muscle strain. With the increase in HIIT training, HIPT training, kettlebells, and Olympic weightlifting in the general population, we caution personal trainers from trying these techniques unless the client is athletic enough to perform the exercises safely at these higher intensities. Personal trainers should also feel comfortable teaching these exercises and have appropriate safety precautions. Not all clients are appropriate for all exercises, however it is possible to modify exercise routines to increase safety.

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