Impact of Age on the Affective Responses Following Worksite Resistance Exercise in Career Firefighters

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ABSTRACT

GERSTNER, G. R., A. J. TRIVISONNO, M. R. LAFFAN, H. K. GIULIANI-DEWIG, J. A. MOTA, J. K. REGISTER-MIHALIK, and E. D. RYAN. Impact of Age on the Affective Responses Following Worksite Resistance Exercise in Career Firefighters. *Med. Sci. Sports Exerc.*, Vol. 55, No. 12, pp. 2263–2270, 2023. **Introduction:** The purpose of this study was to examine the impact of age on the affective responses (attitude, feelings, self-efficacy, intention, enjoyment, and fondness) after a worksite circuit-style resistance exercise routine in career firefighters. **Methods:** Nineteen young (25.5 ± 3.3 yr) and 19 middle-aged male career firefighters (50.3 ± 3.5 yr) completed 2 d of physical testing at local fire stations. Participants were familiarized with the resistance training exercises (deadlift, shoulder press, lunge, and upright row) at visit 1 and performed a multirepetition maximum (RM) assessment to prescribe the appropriate loads for the resistance exercise bout on visit 2. The resistance training session included three sets of 8 to 10 repetitions per exercise at 80% 1-RM. Participants completed a postexercise questionnaire examining affective responses and a rating of perceived exertion (RPE). Mann–Whitney *U* tests and an independent t-test were used to determine differences between the young and middle-aged firefighters' affective responses and RPE, respectively. **Results:** There were no significant differences between groups for any of the six affective responses ($P = 0.062–0.819$) or RPE ($P = 0.142$). **Conclusions:** Age did not influence the perceived effort or affective responses following an acute bout of worksite resistance exercise. Firefighters reported overall positive attitudes, feelings, and fondness paired with high self-efficacy and intention at a training frequency of twice per week. However, confidence, intention, and enjoyment decreased at higher training frequencies (i.e., 3–4x per week). Circuit-style resistance training performed twice per week may be a feasible and practical worksite exercise routine across ages in the fire service. **Key Words:** CIRCUIT TRAINING, SELF-EFFICACY, INTENTION, ENJOYMENT, FIRE SERVICE, AGING

Firefighters experience one of the highest rates of occupational injuries (1), with about 35% of those injuries occurring on the fireground (2). In 2020, the National Fire Protection Association reported approximately 64,875 firefighter injuries occurred while on duty, which has increased 7% from the previous year (2). The most commonly reported nonfatal injuries are strains and sprains (2,3) to the extremities and back (3), which are attributed to acute overexertion and slips, trips, and falls (2). The economic burden of these injuries comes at a high cost as demonstrated by above average worker's compensation claims (4), extended worker absence rates (5,6), and early retirement (7).

Exercise is considered a primary approach to reducing injuries in the fire service (8,9). Yet, over 75% of firefighters fail to achieve the minimum physical activity recommendations (i.e., aerobic exercise) from the American College of Sports Medicine (10). Consequently, exercise programming designed to help motivate firefighters to engage in physical activity are important. Social cognition models are commonly used for understanding health behavior, which has provided some evidence that affective responses play a significant role in exercise behavior. Researchers have therefore focused attention on social cognition determinants which might explain the individual differences in health behavior. For instance, experiencing favorable affective responses to an acute exercise bout has been

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suggested to influence the likelihood that one would choose to engage in exercise in the future (11,12).

Creating exercise programs in the fire service produces unique concerns around scheduling due to the long shift hours (e.g., 24 h) and rotating days of work each week. However, implementing exercise directly at the worksite (i.e., fire station) may provide the most advantageous setting to improve the exercise habits of firefighters. Potential advantages include ease of access to equipment, lower associated-costs, and improved camaraderie among workers (13). For instance, camaraderie and convenience have been identified as key facilitators to motivate firefighters to participate in a worksite exercise programs likely due to accountability, team building, and having designated exercise time (14,15). Previous studies have demonstrated the effectiveness of worksite exercise to improve occupational preparedness (16), working physical capacity, musculoskeletal pain, the reduction in the incidence of injury (6,17) as well as reduced mental fatigue and improved recovery (14). Furthermore, strength and power are critical to conducting essential firefighter tasks safely (18,19), both of which can be improved with resistance training (20–22). Therefore, a worksite resistance exercise routine may be a valuable means to reduce injuries and improve performance in the fire service.

Nearly all career firefighters within the United States assigned to frontline duty are between the ages of 20 to 59 yr (23). Given the large age range of firefighters, we sought to determine if middle-aged firefighters reported different affective responses to an acute bout of resistance exercise when compared to their younger counterparts. It is possible that middle-aged individuals may report lower exercise-related affective responses compared with their younger counterparts (11,12), which may impact the implementation of an exercise routine in the fire service. The exercise routine in the present study was designed to (1) be feasibly implemented at fire stations (e.g., brief, requires minimal equipment, can be performed in a group setting) and (2) engage major muscle groups by incorporating upper and lower body multi-joint movements. Therefore, the purpose of this study was to examine the impact of age on the affective responses following a feasible worksite circuit-style resistance exercise routine in career firefighters. To determine affective responses of the bout of exercise, we employed a cross-sectional postexercise questionnaire on the firefighters' attitudes, feelings, self-efficacy, intention, enjoyment, and fondness.

METHODS

Participants

Forty-one (20 young and 21 middle-aged) male career firefighters volunteered for this study and were recruited by age (young: 18–30 yr; middle-aged: 45–60 yr) from local fire departments. All firefighters were considered frontline duty (i.e., operations on 24-h shifts). Three participants withdrew from the study (1 young, 2 middle-aged) following familiarization testing. Thirty-eight participants completed the two visits (19 young and 19 middle-aged firefighters) and were included in all analyses. None of the participants reported any neuromuscular, cardiovascular, or metabolic disease (i.e., diabetes), had a current or recent (within the past 3 months) musculoskeletal injury of the upper- or lower-body and/or lower back. Furthermore, none of the participants were involved in an active workers' compensation or personal injury case, or currently performed more than three sessions per week of resistance training over the last 3 months. The average reported hours of resistance training per week for all participants was 2.00 ± 2.15 h·wk^{-1} over the past month. In addition, participants agreed to abstain from vigorous exercise for 48 h and abstain from caffeine, tobacco, and alcohol (8 h) prior to both visits. This study was approved by the university institutional review board. All participants provided written and dated informed consent (IRB 18-0025) to participate in the present study.

Experimental Design

The participants completed 2 d of testing at local fire stations that included a familiarization (visit 1) and an acute resistance exercise bout (visit 2). All visits were completed in the morning around the same time of day (±2 h). This study was part of a larger study published previously (24).

Familiarization (Visit 1)

Each firefighter reported for visit 1 immediately after a shift, at least 4 d (mean ± SD, 7.5 ± 3.2 d) before visit 2 to ensure all familiarization assessments did not influence subsequent testing. All participants read and signed an informed consent as well as a health history questionnaire. Participants had their stature and body mass measured using a calibrated clinical scale (Seca 769, Hamburg, Germany). Participants were then familiarized with the resistance training exercises. To prescribe the appropriate loads for the resistance exercise bout, each firefighter performed a multirepetition maximum assessment for each exercise (deadlift, shoulder press, lunge, and upright row) similar to the procedures described by the National Strength and Conditioning Association (25). Participants were initially instructed how to complete each exercise safely using proper form. The deadlift was completed using a kettlebell handle (KettleClamp, In The Box RX, LLC) and a commercially available plate-loaded dumbbell (ODH-20, Ader Sporting Goods, Dallas, TX). The shoulder press and lunges were completed using adjustable dumbbells (PowerBlock Inc., Owatonna, MN) and the upright row was completed using a single adjustable dumbbell with a kettlebell handle (PowerBlock Inc.). They performed a weighted warm-up for each exercise, with progressively heavier loads, for sets of 8 to 10 and 4 to 6 repetitions with 1 min of rest between sets. After completing the warm-up sets, participants were given 2 min of rest. An estimated weight that the participant could lift for six repetitions was then selected for the participant to perform one set of as many repetitions as possible to failure. Using the weight and number of repetitions the participant completed, the participant's one

repetition maximum (1RM) was estimated using the following modified equation (26).

$$1RM = \frac{\text{Repetition Weight}}{0.522 + 0.419e^{(-0.055 \times RTF)}}$$

The repetition weight is the load (kg) used for each exercise and RTF is the number of repetitions completed to failure. This calculation was used to estimate the 1RM for each exercise.

Resistance Exercise (Visit 2)

The resistance exercise bout occurred following a participant's shift. Participants first completed a brief warm-up set using 40% of their predicted 1RM, which was also used to reinforce proper lifting form. Each firefighter then performed three sets of the deadlift, shoulder press, lunge, and upright row exercises (Fig. 1) at 80% of their predicted 1RM until muscular failure. These exercises were selected because they are multi-joint movements (two lower body and two upper body) that engage major muscle groups and can be performed with minimal equipment. The exercises were performed in a circuit-style using an adjustable dumbbell set (same as testing) and there was 1 min of rest between exercises and 2 min of rest between sets. If participants completed more or less than 8–10 repetitions the loads were increased or decreased by 10% for the subsequent set. An experienced member of the research team was present at all times to ensure safe execution of the lifts. Participants completed a postexercise questionnaire examining the following constructs regarding the RT bout that included attitude, feelings, self-efficacy, intention, enjoyment, and fondness similar to a previous study by Jung et al. (27). The full list of questions and scoring for these constructs are displayed in Table 2 and discussed in further detail below. Rate of perceived exertion (RPE) was assessed with the OMNI resistance training RPE scale (28) at the completion of the exercise bout. The OMNI RPE scale ranged from extremely easy (0) to extremely hard (10).

Attitudes. Attitudes signify the individual's evaluation of a behavior (29). For instance, Hagger et al. (30) demonstrated that positive attitudes were more likely to form intentions to exercise. The attitude construct statements for this study were specific to ease of implementation, injury prevention, and health improvement resulting from the resistance training bout. For example: "The workout I performed today could be easily implemented in my department." The anchors ranged from strongly disagree, 1, to strongly agree, 5.

FIGURE 1—Examples of the four resistance training exercises including the (A) deadlift, (B) shoulder press, (C) lunges, and (D) upright row.

Feeling. The one-item feeling scale (31) asked the participant to: "Please rate your feeling towards the bout of exercise you just completed." The anchors ranged from very bad (−5) to very good (+5) with seven anchors provided on the 11-point scale.

Task self-efficacy. Firefighters' confidence in their ability to repeat the exercise they just completed was assessed postexercise on an 11-point scale. The anchors ranged from not at all (0%) to extremely confident (100%) and were coded as 0 to 10 for analyses. Similar to Jung et al. (2014), the self-efficacy questions asked the participant to rate their confidence on performing the exercise routine based on frequency. In the present study, we used a frequency of two to four times per week over the next several months (i.e., 3 items). For example: "How confident are you that you can perform this exercise routine at least two times per week over the next 3 months?"

Intention. Firefighters' intention to engage in the exercise they just completed was assessed postexercise on a seven-point scale. The anchors ranged from very unlikely (1) to very likely (7). Similar to Jung et al. (2014), the intention statements asked the participant to rate their intention on engaging in the type of exercise based on frequency. In the present study, we used a frequency of two to four times per week over the next several months (i.e., 3 items). For example: "I intend to engage in the type of exercise I performed today at least two times per week over the next 3 months."

Enjoyment. The 4-item enjoyment questionnaire asked the participant to rate their enjoyment on performing the exercise routine today and the anticipated enjoyment of the exercise just completed if they were to do it again in the future (27). The enjoyment statements asked the participant to rate their enjoyment on engaging in the type of exercise based on frequency. In the present study, we used a frequency of two to four times per week over the next several months (i.e., 3 items). For example: "How enjoyable would you find engaging in this form of exercise at least two times per week over the next 3 months?" The anchors ranged from not at all, 1, to extremely, 7.

Fondness. A one-item fondness scale asked the participant to: "Please rank your fondness for the workout you just performed." The anchors ranged from very much dislike, 1, to extremely like, 7 (27).

Statistical Analysis

Descriptive data were summarized using mean ± SD and range values (Table 1). All questions are detailed in Table 2. Internal consistency of the constructs with multiple statements (attitudes, self-efficacy, intentions, enjoyment) were measured using Cronbach's alpha (Table 2). Mann–Whitney *U* tests were used to determine differences in each construct between the young and middle-aged firefighters. An independent *t* test was used to determine differences in RPE between the young and middle-aged firefighters. An alpha level was set *a priori* at 0.05 for all analyses. Measures were analyzed using SAS software, version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

Demographics

All demographic data are presented in Table 1 and have been previously reported (24). The rating of perceived exertion (RPE) at the completion of the exercise bout was not significantly different between groups (P = 0.142; young: 8.95 ± 1.13, middle-aged: 9.17 ± 0.79). The Cronbach's alpha for self-efficacy, intention, and enjoyment exceeded the criterion of 0.70 suggesting high internal consistency (Table 2; α = 0.85–0.93). However, the three statements for the attitude construct did not demonstrate high internal consistency (Table 2) and were therefore considered different attitude constructs. There were no significant differences between age groups for attitudes, feelings, self-efficacy, intentions, enjoyment, and fondness (Table 2; P = 0.062–0.819). Table 3 displays the frequency and percentage of answers to the statements/questions for the young and middle-aged firefighters combined. Most of the firefighters agreed or strongly agreed that the exercise bout they completed could be easily implemented (86.8%), would be beneficial for injury prevention (73.7%), and would help improve the health and fitness of the department (92.1%). No firefighters reported negative feelings while 84.2% reported feeling good to very good after the exercise routine.

Approximately 81.6% of firefighters felt 80% to 100% confident in completing the exercise routine at a frequency of twice per week over the next 3 months, with confidence decreasing as the frequency of the routine increased per week (e.g., 81.6% of firefighters were 80–100% confident at twice per week, 57.9% were 80–100% confident at three times per week, and 21.0% were 80–100% confident at 4 $d \cdot wk^{-1}$). Similarly, intention and enjoyment decreased across increasing frequency, specifically among those who reported high values (i.e., 6 and 7 out of 1–7 scale) at the frequency of twice per week (see Table 3). For intention, 55.3% reported likely [6] to very likely [7] on exercise engagement twice per week versus 7.9% reported likely [6] to very likely [7] on exercise engagement four times per week. For enjoyment, 39.5% reported very much [6] to extremely [7] on exercise engagement twice per week versus 7.9% reported very much [6] to extremely [7] on exercise engagement four times per week. The majority

TABLE 1. Mean ± SD and range values for demographics and estimated 1RM in young and middle-aged firefighters.

	Young	Older
Age (yr)	25.5 ± 3.3 (19–31)	50.3 ± 3.5 (45–58)
Stature (cm)	180.8 ± 6.4 (169.5–197.0)	176.6 ± 6.8 (163.4–189.5)
Body Mass (kg)	93.4 ± 17.9 (71.4–137.9)	93.3 ± 11.6 (69.1–221.6)
BMI ($kg \cdot m^{-2}$)	28.3 ± 5.4 (19.9–39.0)	30.6 ± 4.5 (23.2–41.5)
Deadlift 1RM (kg)	118.1 ± 29.9 (54.4–166.0)	103.1 ± 23.8 (63.1–159.2)
Shoulder Press 1 RM (kg)	23.9 ± 4.5 (15.4–34.5)	22.2 ± 4.6 (14.1–33.6)
Lunge 1 RM (kg)	23.1 ± 4.2 (15.9–30.8)	17.8 ± 5.3 (10.4–27.7)
Upright Row 1RM (kg)	49.0 ± 6.5 (34.5–58.1)	42.9 ± 7.6 (26.3–55.3)

Note: (Young: n = 19, Middle-Aged: n = 19).
BMI body mass index.

(84.2%) of the firefighters reported slight liking to extreme liking of the workout routine on the exercise fondness scale.

DISCUSSION

The current study examined the impact of age on the affective responses following a worksite resistance exercise routine (i.e., four exercises for three sets in a circuit-style) in career firefighters. The primary findings of the present study indicated there were no significant differences on the affective responses (i.e., attitude, feelings, self-efficacy, intention, enjoyment, and fondness) or perceived exertion between young and middle-aged firefighters. Attitudes and feelings towards the routine were overall positive with over half of firefighters showing fondness. The majority of firefighters were at least 80% confident in completing the exercise routine twice per week, but less confident in completing the routine three to four times per week. Similarly, intention and enjoyment decreased as frequency of the routine increased in firefighters who reported high intentions and enjoyment initially at twice per week.

Firefighters' attitudes are important to consider in the context of efforts to implement exercise at the fire station. Specifically, attitudes about exercise likely impact the adoption, engagement, and adherence of the exercise being implemented (32). Attitudes are shaped by salient beliefs about the consequences of the behavior and are influenced by values of these consequences (33). Within our sample, most firefighters agreed or strongly agreed that the exercise bout they completed could

TABLE 2. Internal consistency and mean ± SD for affective responses for young and middle-aged firefighters

				Young			Middle-Aged		
Construct	**Scoring**	**Statement/Question**	**Cronbach's α**	**Mean ± SD**	**95% CI**	**Median (IQR)**	**Mean ± SD**	**95% CI**	**Median (IQR)**
Attitudes[a]			0.61						
Implementation	*1-5*	The workout I performed today could be easily implemented in my department.		4.26 ± 0.56	3.99-4.53	4.00 (4.00, 5.00)	3.79 ± 0.98	3.32-4.26	4.00 (4.00, 4.00)
Injury Prevention	*1-5*	My department would sustain fewer on-duty injuries if we performed the exercise routine consistently.		3.84 ± 0.69	3.51-4.17	4.00 (3.00, 4.00)	3.89 ± 0.57	3.62-4.17	4.00 (4.00, 4.00)
Health Improvement	*1-5*	My department's fitness and health would improve if we performed this exercise routine consistently.		4.47 ± 0.51	4.23-4.72	4.00 (4.00, 5.00)	4.11 ± 0.66	3.79-4.42	4.00 (4.00, 5.00)
Feeling									
	-5- + 5	Please rate your feeling towards the bout of exercise you just completed.	-	3.16 ± 1.07	2.64-3.67	3.00 (3.00, 4.00)	3.47 ± 1.65	2.68-4.27	4.00 (3.00, 5.00)
Self-Efficacy			0.93	7.21 ± 1.69	6.40-8.02	7.67 (5.67, 8.67)	7.05 ± 2.47	5.86-8.24	7.67 (6.33, 8.33)
		How confident are you that you can perform this exercise routine at least 2 times per week over the next 3 months?		*8.74 ± 1.24*		*9.00 (8.00, 10.00)*	*8.37 ± 2.11*		*9.00 (8.00, 10.00)*
	0-10	How confident are you that you can perform this exercise routine at least 3 times per week over the next 3 months?		*7.42 ± 1.71*		*8.00 (6.00, 9.00)*	*7.42 ± 2.81*		*8.00 (6.00, 10.00)*
		How confident are you that you can perform this exercise routine at least 4 times per week over the next 3 months?		*5.47 ± 2.57*		*5.00 (3.00, 7.00)*	*5.37 ± 2.79*		*5.00 (4.00, 7.00)*
Intention			0.92	4.47 ± 1.32	3.84-5.11	4.67 (3.00, 5.67)	4.18 ± 1.82	3.31-5.06	3.67 (3.00, 6.00)
		I intend to engage in the type of exercise I performed today at least 2 times per week over the next 3 months.		*5.68 ± 1.11*		*6.00 (5.00, 7.00)*	*5.13 ± 1.85*		*5.00 (4.00, 7.00)*
	1-7	I intend to engage in the type of exercise I performed today at least 3 times per week over the next 3 months.		*4.58 ± 1.57*		*4.00 (3.00, 6.00)*	*4.53 ± 2.04*		*5.00 (3.00, 7.00)*
		I intend to engage in the type of exercise I performed today at least 4 times per week over the next 3 months.		*3.16 ± 1.64*		*3.00 (2.00, 5.00)*	*2.89 ± 1.88*		*3.00 (1.00, 4.00)*
Enjoyment			0.85	4.32 ± 0.97	3.85-4.79	4.00 (3.50, 5.00)	4.51 ± 1.37	3.85-5.17	4.75 (3.25, 5.75)
		How much did you enjoy the exercise you just completed today?		*4.84 ± 0.96*		*5.00 (4.00, 6.00)*	*5.37 ± 1.21*		*5.00 (5.00, 7.00)*
	1-7	How enjoyable would you find engaging in this form of exercise at least 2 times per week over the next 3 months?		*4.84 ± 1.07*		*5.00 (4.00, 6.00)*	*5.18 ± 1.57*		*5.00 (4.00, 7.00)*
		How enjoyable would you find engaging in this form of exercise at least 3 times per week over the next 3 months?		*4.21 ± 1.18*		*4.00 (3.00, 5.00)*	*4.42 ± 1.87*		*5.00 (3.00, 6.00)*
		How enjoyable would you find engaging in this form of exercise at least 4 times per week over the next 3 months?		*3.37 ± 1.54*		*3.00 (2.00, 5.00)*	*3.05 ± 1.78*		*2.00 (2.00, 5.00)*
Fondness									
	1-7	Please rank your fondness for the workout you just performed:	-	5.26 ± 0.87	4.84-5.68	5.00 (5.00, 6.00)	5.61 ± 1.06	5.09-6.12	6.00 (5.00, 6.00)

CI, confidence interval; SD, standard deviation; IQR, interquartile range

Cronbach's alphas are included for constructs that have multiple statements/questions (i.e., attitudes, self-efficacy, intentions, and enjoyment). For the attitudes construct, Cronbach's alpha was assessed for the total construct (i.e., three statements), and all combinations of two statements to see if there was any internal consistency. Therefore, [a]indicates multiple statements are counted as separate themes of a construct where Cronbach's alpha was <0.70.

Mann-Whitney U tests were run on the total construct for self-efficacy, intentions, and enjoyment; however, mean ± SD and median (IQR) are provided for each statement/question.

Italics indicates values for a single question that was part of a construct with multiple statements/questions.

TABLE 3. Frequency and percent values for affective responses for young and middle-aged firefighters combined

Construct	Anchors n (%)										
Attitudes	***Strongly disagree***		***Disagree***			***Neither disagree or agree***			***Agree***		***Strongly agree***
Implementation	1 (2.63%)		1 (2.63%)			3 (7.89%)			24 (63.16%)		9 (23.68%)
Injury Prevention	0 (0%)		0 (0%)			10 (26.32%)			23 (60.53%)		5 (13.16%)
Health Improvement	0 (0%)		0 (0%)			3 (7.89%)			21 (55.26%)		14 (36.84%)
Feeling	***Very bad***		***Bad***		***Fairly bad***	***Neutral***	***Fairly good***		***Good***		***Very good***
	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (5.26%)	3 (7.89%)	1 (2.63%)	16 (42.11%)	7 (18.42%)	9 (23.68%)
Self-Efficacy	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
2x/week	0 (0%)	0 (0%)	0 (0%)	1 (2.63%)	1 (2.63%)	1 (2.63%)	0 (0%)	4 (10.53%)	9 (23.68%)	7 (18.42%)	15 (39.47%)
3x/week	0 (0%)	1 (2.63%)	1 (2.63%)	1 (2.63%)	0 (0%)	5 (13.16%)	3 (7.89%)	5 (13.16%)	7 (18.42%)	8 (21.05%)	7 (18.42%)
4x/week	2 (5.26%)	1 (2.63%)	2 (5.26%)	4 (10.53%)	3 (7.89%)	10 (26.32%)	1 (2.63%)	7 (18.42%)	3 (7.89%)	2 (5.26%)	3 (7.89%)
Intention	***Very Unlikely***					***Neutral***					***Very Likely***
2x/week	1 (2.63%)[a]	1 (2.63%)		2 (5.26%)		7 (18.42%)	6 (15.79%)		9 (23.68%)		12 (31.58%)
3x/week	1 (2.63%)	4 (10.53%)		8 (21.05%)		6 (15.79%)	6 (15.79%)		5 (13.16%)		8 (21.05%)
4x/week	11 (28.95%)	6 (15.79%)		4 (10.53%)		9 (23.68%)	5 (13.16%)		2 (5.26%)		1 (2.63%)
Enjoyment	***Not at all***	***Very little***		***Slightly***		***Moderately***	***Quite a bit***		***Very much***		***Extremely***
Today	0 (0%)	0 (0%)		1 (2.63%)		12 (31.58%)	13 (34.21%)		6 (15.79%)		6 (15.79%)
2x/week	1 (2.63%)[a]	0 (0%)		2 (5.26%)		13 (34.21%)	7 (18.42%)		9 (23.68%)		6 (15.79%)
3x/week	1 (2.63%)	3 (7.89%)		9 (23.68%)		8 (21.05%)	7 (18.42%)		7 (18.42%)		3 (7.89%)
4x/week	6 (15.79%)	10 (26.32%)		6 (15.79%)		6 (15.79%)	7 (18.42%)		2 (5.26%)		1 (2.63%)
Fondness	***Very much dislike***					***Neutral***					***Extremely like***
	0 (0%)	0 (0%)		1 (2.63%)		5 (13.16%)[a]	14 (36.84%)		13 (34.21%)		5 (13.16%)

[a]If an observation was scored as a fraction (e.g., 1.5), the value was rounded down (e.g., 1) to stay consistent with the anchoring system.

be easily implemented (86.8%), would be beneficial for injury prevention (73.7%), and would help improve the health and fitness of the department (92.1%). Emotion or affect is also an important variable to consider as feelings may be expected to impact beliefs and attitudes about a behavior (34). Firefighters scored high on the feeling scale (grand mean: 3.32 out of −5 to +5) compared to previous literature comparing postexercise affect following bouts of aerobic high intensity interval training (1.42) and continuous moderate intensity training (2.85) on a cycle ergometer (27) yet similar to resistance training (3.24) (35). Based on the nonlinear exercise intensity–affect relationship (36), this may suggest this exercise bout was not overly strenuous exercise for the firefighters, which would have otherwise elicited a more negative response. Given that the majority of firefighters reported positive attitudes and affect in response to the circuit-style resistance training bout of exercise, this may suggest there is fertile ground for implementing similar exercise interventions within the fire service across a wide range of ages. In particular, positive attitudes and affect suggest a similar routine could be adopted and engaging for firefighters.

Attitudes have been reported to be the best predictor of behavioral intentions (37); therefore, the high percent of positive attitudes likely influenced the high intention seen for performing the exercise bout twice per week (grand mean, 5.41 of 1–7). However, firefighters reported a lower intention to perform the exercise bout three (grand mean, 4.55) or four (grand mean, 3.03) times per week. This was mirrored in task self-efficacy with all firefighters reporting the highest average confidence level of 85.5% for performing the exercise bout twice per week. This is not surprising as behavioral intention reflects task self-efficacy (i.e., confidence in completing this exercise routine) (38). While self-efficacy is often thought of as a separate theory from the Theory of Planned Behavior, Ajzen (29) argues that perceived self-efficacy is one preceding component of perceived behavioral control. Self-efficacy has been operationalized into different types such as task and coping self-efficacy (i.e., overcoming obstacles impeding the desired outcome) to assess confidence in exercise behavior (38). Studies (39,40) have indicated that individuals who report a high level of self-efficacy for exercise behavior will likely exercise more frequently and have greater adherence to exercise programs. Furthermore, it has been proposed that frequency is the "most potent source of exercise self-efficacy information" where it influences self-efficacy directly and indirectly through affective responses (41). Thus, when creating feasible worksite exercise interventions, frequency is a critical factor. When taking into account the complexity of a work shift for a firefighter, scheduling a fixed frequency must also be considered. Interestingly, Rodgers et al. (38) demonstrates in a pathway analysis that for different self-efficacy constructs (i.e., task and scheduling), scheduling (a subtype of coping) but not task self-efficacy significantly led to the desired behavior. Therefore, scheduling efficacy may be an important construct to capture in subsequent investigations to ascertain what is realistic for firefighters on 24-h rotating shifts who may have one or less shifts on specific weeks. A potential limitation to our self-efficacy questioning

was the phrasing that included "this exercise routine." Future studies using a similar research design in firefighters may consider using "a similar exercise routine."

Enjoyment has consistently been recognized as a significant factor for exercise adherence (42,43). Previous studies (27,44) have reported greater enjoyment in high-intensity interval training in comparison to continuous aerobic exercise (moderate and/or vigorous) despite a less positive affect (i.e., feeling scale score). Similar to the decrease in intention and self-efficacy across frequency in our sample, enjoyment decreased across frequency as well. Hu et al. (42) found that postexercise self-efficacy was associated with one's enjoyment of exercise, and that the relationship was stronger with greater exertion. This supports the notion that the self-efficacy and enjoyment relationship is influenced by exercise intensity (42), which is not surprising as intensity has been noted as a mediator of affective responses (36,45). Regarding fondness, only one firefighter reported slightly disliking the exercise bout, five remained neutral, and the rest of our sample (n = 32) reported slight to extreme fondness. Although our study only looked at one exercise mode, previous research (27,44) has shown that fondness is greater for interval type training over continuous aerobic exercise (moderate and/or vigorous) despite a less positive affect (i.e., feeling scale score). It is possible that this fondness is reflective of the high enjoyment, perceived confidence, and the short time frame it took to complete the exercise bout at the frequency of twice per week.

Practical Applications and Limitations

Resistance training has been shown to improve health, reduce risk of injury, and enhance performance (17,22,46), which are of critical importance to various critically essential firefighter tasks. Previous work (47) has demonstrated that circuit-based resistance training may be an appropriate routine for firefighters as it allows for multiple firefighters to exercise simultaneously, requires minimal time and space at the fire station, and a chance to further foster a team-based environment. In addition, we also have also demonstrated that young and middle-aged firefighters have a similar recovery following a circuit-based worksite exercise routine, which may enhance implementation efforts across all age ranges in firefighters (24).

While several exercise interventions have been implemented in the fire service (14,47–50), considerations of feasibility and acceptability are essential. Previous qualitative studies (14–16,51) identified key barriers such as lack of time (14–16), lack of motivation (14,15,51), and lack of social support (e.g., peer or supervisor) (14–16,51). Specifically, firefighters have indicated that having a mandated or uninterrupted time to exercise (14,15,51), preferably in a group setting (14,15), would improve their adherence to exercise. Nevertheless, since emergency calls cannot be planned, on-site exercise adherence is likely to be impacted (16).

The aforementioned barriers to exercise implementation need be addressed to elicit successful and sustainable worksite exercise programs to effectively reduce the risk of fatal and nonfatal injuries in firefighters (49,50). The results of this study in conjunction with previously noted barriers highlight that scheduling (i.e., frequency per week or having uninterrupted sessions) structured exercise remains a foremost concern. However, our exercise routine shows promise in that it directly addresses key exercise adherence barriers including a brief, cost-effective (e.g., limited equipment) exercise routine that can be delivered in a group setting to embrace comradery within firefighters across age groups.

CONCLUSIONS

In summary, the primary findings of the current investigation indicate young and middle-aged career firefighters have similar affective responses and perceived exertion after the brief, on-site, free-weight circuit-style resistance exercise routine. These findings may suggest this type of exercise routine would be acceptable across the broad age range of firefighters. Our sample reported overall positive attitudes, feelings, and fondness paired with high self-efficacy and intention at a frequency of twice per week. However, the frequency of exercise implementation may play a major role in feasibility as we observed decreased confidence, intention, and enjoyment at three and four times per week. Moreover, due to the rotating nature of firefighter shifts, their shift schedule may impede programming on-duty exercise more than twice per week. These data suggest a circuit-style resistance training bout performed twice per week may be a feasible and practical approach to implement exercise across a range of ages in the fire service.

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