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Nutrition Intervention Through a Social Media Platform on Nutrition Knowledge and CVD Risk Factors Amongst Firefighters

Original Research

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Abstract

Introduction: Cardiovascular disease (CVD) is the number one cause of on-duty death for firefighters. Risk factors such as hypertension, obesity, and elevated cholesterol can be used as predictors in the prevention and intervention of CVD. Social media (SM) has become a popular platform for delivering health and wellness information. The aims of this study were to examine the utility of nutrition education through a dedicated social media platform (Instagram) for supporting and enhancing nutrition knowledge and in reducing CVD risk factors amongst firefighters.

Methods: In a pilot study, firefighters (n=53) were exposed to a private IG account for 6 weeks. The intervention was delivering daily evidence-based nutrition information via the SM platform. A validated Questionnaire (ANSKQ) was administered before and after the 6-week intervention period. Nutrition knowledge, anthropometric and vitals data were collected pre-post intervention.

Results: Data analysis is presented as the mean, ± SD, $p<0.05$ was deemed significant. ANSKQ results were evaluated by total, general and sports nutrition knowledge scores. The total mean score significantly increased from 46% ± 3.27 to 52% ± 13.43 ($p<0.0017$). A 5% increase in GNK scores was also observed over the study period [60% ± 15.35 to 65% ± 19.83 ($p<0.04409$)]. SNK scores increased by 6% over the study period [39% ± 16.01 to 45% ± 14.25 ($p<0.0108$)]. Participants lost an average of 1.54 kg ± 2.29 ($p<0.00007$) over the study period.

Conclusions: This study suggests that nutrition education that impacts change in habits and health can be delivered over a dedicated interactive social media platform. This can have an impact on nutrition knowledge and health behaviors, as well as health outcomes in fire-fighters.

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Key Words: Sports nutrition, Cardiovascular Disease, First responders

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Introduction

Cardiovascular Disease (CVD) is the number one cause of on-duty death for firefighters 1. Currently, CVD kills more firefighters than any other cause, including structural collapse, burns, and smoke inhalation 2. Sudden cardiac deaths now account for 50% of the annual on-duty firefighter deaths 2. The National Fire Protection Association reports that

of the firefighters lost to sudden cardiac death from 1995 to 2004, nearly half of them had a documented history of heart disease, which could have been treated 3,4. Risk factors such as high blood pressure (hypertension), Body mass index (BMI) greater than 30.0 (obesity), and elevated cholesterol (Hyperlipidemia), namely low-density-lipoproteins (LDL) and triglycerides, can be used as biomarkers in the prevention and treatment of CVD 1,5. While heart attacks and strokes present with devastating effects on firefighters' health, they are largely preventable through the control of certain risk factors through behavior modification 6,7. These factors include correcting a poor diet, increasing physical activity levels, reducing cholesterol levels, decreasing the occurrence of overweight and/or obesity rates and lowering blood pressure 4,6,7.

During the era of COVID-19, medical and healthcare services had begun to pave the way for the future of healthcare through "telehealth" 8. Telehealth is the distribution of health-related services via electronic information and telecommunication technologies. COVID-19 quarantine presented many problems for people to access healthcare services and medical advice 8. Social media had become a popular platform for promoting telehealth services. Social media's popularity for networking health and fitness continues to grow. Social media is used by more than half of the world's population and encompasses a wealth of information including topics about health, wellness, and nutrition9.

Although some studies have measured the feasibility and efficacy of social media-based interventions on health behaviors, none have examined the efficacy of using a social media platform 10, such as Instagram (IG), for measuring nutrition knowledge and health improvements in firefighters. The primary aim of this study is to examine the utility of online nutrition education through a social media platform (Instagram) for reducing CVD risk factors amongst firefighters. Measurements were analyzed through anthropometrics, such as height, weight, BMI calculation, and resting blood pressure (systolic and diastolic). The secondary aim of the study was to assess the effectiveness of nutrition education delivered through social media within the firefighter community. Measurements were analyzed through a validated nutrition questionnaire, namely the Abridged Nutrition for Sport Knowledge Questionnaire (ANSKQ) developed by Trakman et al 11.

Several studies have found a strong prevalence of overweight and obesity amongst the fire community 12. Obesity rates ranged from 32-40% and a combination of overweight/obese was between 77-90% in professional firefighters 12. Career firefighters reported an average of 35-40% increase in weight after five-years of on job duty 12. Emerging data regarding the US Fire Service shows the greater compliance with the Mediterranean Diet is associated with improved CVD risk profiles and less weight gain amongst career firefighters 13,14.

Along with obesity rates being linked to CVD, hypertension (HTN) is a well-known risk factor that increases the probability for developing coronary heart disease, stroke, and total mortality 15. High blood pressure is defined as having a systolic pressure (the top number in a reading) as 130 mm Hg or higher and a diastolic blood pressure (the bottom number) of 80 mmHg or higher as defined by the American Heart Association. An estimated 1.2 million firefighters are included in the list of high hypertension prevalence occupational jobs in the United States 16. Per a Pennsylvania coronary artery disease study amongst firefighters, it reported 41% of the sample size (n-160) had HTN, 38% had pre-HTN with only 12% receiving treatment, and 13.5% being treated for high cholesterol levels 17. Per a cross sectional study examining firefighter's CVD risk factors with physical examination findings suggest that the prevalence of obesity, low HDL, high LDL, and high total cholesterols was relatively higher than the general population 18. Other findings suggest an association with elevated blood pressure, triglyceride, and glucose levels 18. Furthermore, based on the limited research available on firefighter related interventions for cardiovascular disease, it is significant to explore this avenue in treatment and prevention. Because the utility use of social media within this population to combat obesity, dietary behaviors, hypertension, and physical activity has not been explored, this study presents with possible prevention and treatment options for this population.

Scientific Methods

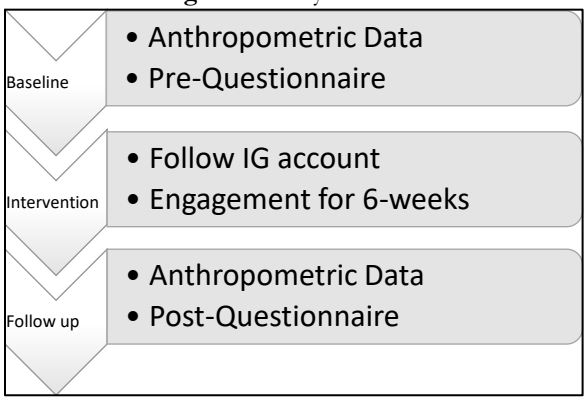
Participants

The study was conducted in male and female firefighters (n=53, 38 male/15 female), aged 23 to 60. Participants were informed as to the study objectives and the aims of the study and were required to read and sign an Institutional Review Board-approved informed consent form prior to their participation in the study. The study was approved by the Nova Southeastern University Institutional Review Board (Davie, FL). The firefighters, the participants were recruited from Broward County, Florida, with assistance in recruitment by the Broward Sheriff's Office (BSO) Risk Management Manager (Broward County, FL.).

Intervention Methods

Informed consent as well as baseline anthropometric data (age, gender, height, weight, and resting blood pressure) was collected through private email messaging. A google survey link was then sent to each study participant containing a validated nutrition questionnaire before and after the six-week intervention period (figure 1). The 35-item questionnaire "Abridged Nutrition for Sport Knowledge Questionnaire" (ANSKQ) developed by Trakman et al was selected to assess participant nutrition knowledge over the general nutrition knowledge questionnaire (GNKQ) to facilitate in shorter completion times and greater probability of compliance. The link was accessible for a duration of 4 weeks with bi-weekly email reminders to complete the questionnaire before the start of the intervention and 2 weeks at the completion of the intervention period (week 6-8).

Figure 1. Study Timeline



Study methodology began with a baseline data collection of anthropometrics and pre-questionnaire scores followed by the 6-week intervention period concluded by post-data collection of updated anthropometrics and questionnaire scores.

The intervention platform was a dedicated private Instagram account created to follow a 6-week curriculum outlined with matching objectives to meet the study aim of increasing nutrition knowledge. The IG page was designed as a means of delivering evidence-based information from accredited programs and organizations such as the Academy of Nutrition and Dietetics (AND), American Heart Association (AHA), National Strength and Conditioning Association (NSCA), International Society of Sports Nutrition (ISSN), the National Institutes of health (NIH) and the Centers for Disease Control and Prevention (CDC). The Instagram account was kept private to remove extrinsic variables, thus this was a dedicated account for the participants. Meaning, only people invited and consented to the study were approved to follow, engage, and interact in the IG page. The page contained nutrition education materials including videos, fact sheets, recipes, fitness and nutrition infographics, cardiovascular disease awareness articles and shopping/cooking tips. There was new information posted by the lead investigator one to three times per day. As this was interactive firefighters were able to share their questions, or concerns through the Instagram chat and messaging feature. Engagement was highly encouraged by suggesting to the participants to like posts or comment on posts of interest. The weekly curriculum outline was based on targeting specific daily topics ranging from the Mediterranean diet to sports supplements (Table 1). The daily curriculum was designed to address areas of concern like cooking recipes and fun facts. For example, Mondays were a "Meatless Monday" recipe and "Myth Busters" fact sheet. Tuesdays were "Tips and Tricks" on healthy eating. Wednesdays were "Wellness Wednesday" on science proven diet habits and lifestyle changes. Thursdays were "Throwback Thursday" where traditional recipes were made healthier. Fridays were dedicated to "Firefighter health" where anything related to FF health and wellness was discussed. Saturdays were "Smart Saturday" with a nutrition education lesson on different micronutrients. Sundays were "Fun-day Sunday" where hot topics in nutrition were the focus such as the ketogenic diet, vegan athletes, and 'the goods on fats".

At the completion of the six-week intervention period each study participant was sent a new Google Survey link through their private email address and direct messenger on IG containing the same ANSKQ along with additional free response questions to obtain updated self-reported anthropometric data (new weight and resting blood pressure).

Table 1. Instagram Intervention Curriculum Sample

TIMELINE	*SPORTS NUTRITION KNOWLEDGE TOPIC*	*GENERAL NUTRITION KNOWLEDGE TOPIC*	*FIRE-FIGHTER KNOWLEDGE TOPIC*
WEEK 1	BCAA's and protein sources	Mediterranean Diet & Pre/probiotics	Risk factors related to cancer and carcinogen exposure
WEEK 2	Pre-workout supplements and fueling	DASH diet & sodium intake	Relationship of sleep and depression on health status
WEEK 3	Fiber and sugar's role in fueling & recovery	Ketogenic diet and animal protein sources	Cardiovascular Disease awareness
WEEK 4	Macronutrients and collagen	Detoxification diets vs whole food approaches	Alcohol abuse and long term effects

Information in table was created to follow a six-week curriculum outlines with matching objectives to meet the study aim of increasing nutrition knowledge in both categories of general and sports nutrition content along with addressing firefighter related topics.

Questionnaire Methodology

Participant data was collected through Google Survey and secured private email accounts. All information was recorded and saved to the principal investigator's private double-password protected computer. Information from all study participants was kept de-identified and stored in Microsoft Excel sheets. The study examined multiple variables such as pre-post weight (kg), BMI (kg/m2), resting blood pressure (diastolic and systolic), and ANSKQ scores. The questionnaire consists of 35 questions (Total), 11 of which focus on the assessment of general nutrition knowledge (GNK) and the remaining 24 assessed sports nutrition knowledge (SNK). Scores are represented as a percentage for total and each subsection (GNK & SNK) and classified by the following: "poor" (0–49%), "average" (50–65%), "good" (66–75%) and "excellent" knowledge (76–100%)[19].

Statistical Analysis

All data is presented with mean, ± standard deviation, and range. P-values were calculated with a student paired T-test calculator through Social Science Statistics. A p-value of less than or equal to 0.05 was used to indicate statistical significance and values less than 0.10, but greater than 0.05 were deemed trending towards significance. All statistical analysis and graphs were completed using Microsoft Excel software. Changes in pre-post data were examined for clinical significance as well.

Results

Compliance and adverse events

53 subjects signed the IRB approved consent form. Pre-intervention baseline data was collected from all the participants. This baseline data included anthropometrics and nutrition knowledge as assessed by the ANSKQ. In this study, 53 firefighters enrolled and 42 completed each of the six-weeks. Reasons for non-completion were unrelated to the study. There were no reported adverse events related to social media engagement and receiving educational nutrition content over the dedicated social media platform.

Questionnaire analysis

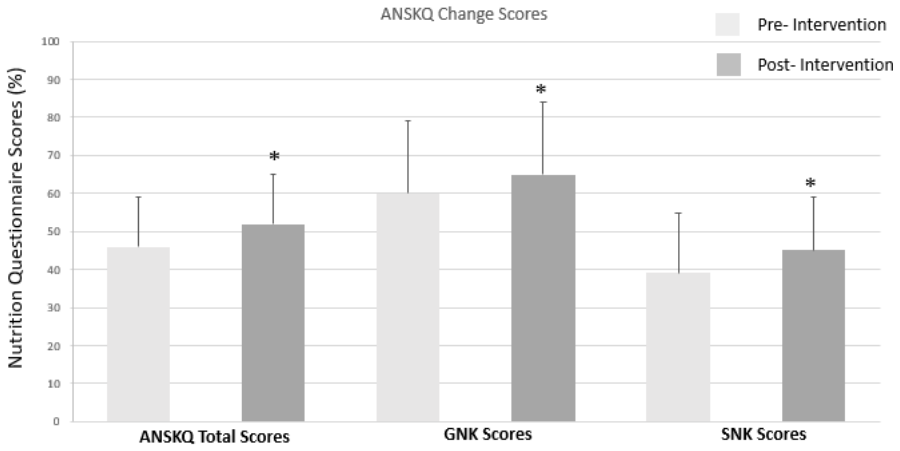
Pre-post ANSKQ results were evaluated by total and subcategory (GNK & SNK) scores (table 2). Total pre-mean score was 46% ± 13.27 classified as "poor" and total post-mean score was 52% ± 13.43 classified as "average". This was a 6% increase in total average scores (*p= 0.0017). GNK pre-mean score was 60% ± 15.35 and GNK post-mean score of 65% ± 19.83, both classified as "average". A 5% increase in GNK change scores was observed resulting in a significant change (*p=0.04409). SNK pre-mean score was 39% ± 16.01 and post-mean score of 45% ± 14.25 both classified as "poor". A 6% increase in SNK change scores resulted in a significant change (*p=0.0108). Results in Figure 2.

Table 2. ANSKQ Results

Group	(n)	Pre-total	Post-Total	Pre-GNK	Post-GNK	Pre-SNK	Post-SNK
Completed	42	46% ± 13	52% ± 13	60% ± 19	65% ± 19	39% ± 16	45% ± 14
Sex							
Male	28	45% ± 14	54% ± 13	57% ± 16	64% ± 21	39% ± 17	49% ± 13
Female	14	47% ± 12	48% ± 14	66% ± 13	69% ± 16	39% ± 14	38% ± 14
Age (yrs)							
20-35	17	46% ± 13	48% ± 14	59% ± 16	65% ± 17	40% ± 15	40% ± 16
36-49	21	49% ± 14	56% ± 11	62% ± 14	68% ± 21	40% ± 17	51% ± 10
50+	4	38% ± 13	44% ± 16	54% ± 19	54% ± 19	31% ± 13	39% ± 14

Data presented with mean ± SD

Figure 2. Total, GNK, and SNK change scores pre vs post intervention.



Data are means ± SD
*p<0.05

Weight loss results

Study participants averaged a weight in kilograms of 89.14 ± 17.08 (196 lbs.) before the intervention and an average weight in kilograms of 87.6 ± 16.79 (192 lbs.) after the intervention (Table 3). This is an average weight loss difference of 1.54 kg (3.4 lbs.) within a 6-week period. Averaging 0.55 lb. (0.25 kg) weight loss per week. The p-value was recorded at 0.00007 (Figure 3) which is statistically significant, however it is not clinically significant because clinically significant weight loss (CWL) is defined as >5% reduction in weight over a period of 6-12 months. The average weight loss reduction for this group (n=42) was 1.7%. Comparing weight change amongst male and female study participants weight loss in both groups was reported. Men (n=28) pre-weight average in kilograms was 94.89 ± 15.61 and a post-weight of 93.5 ± 15.88 (1.39 kg or 3 lb. weight loss). Females (n=14) pre-weight average in kilograms was 77.64 ± 14.15 and post-weight was 75.92 ± 13.83 (1.72 kg or 3.7 lbs. weight loss). Statistical significance was observed for both groups, female weight change p=0.0026 and male weight change p=0.00597. Results in Table 3.

Table 3. Weight Change Results (kg)

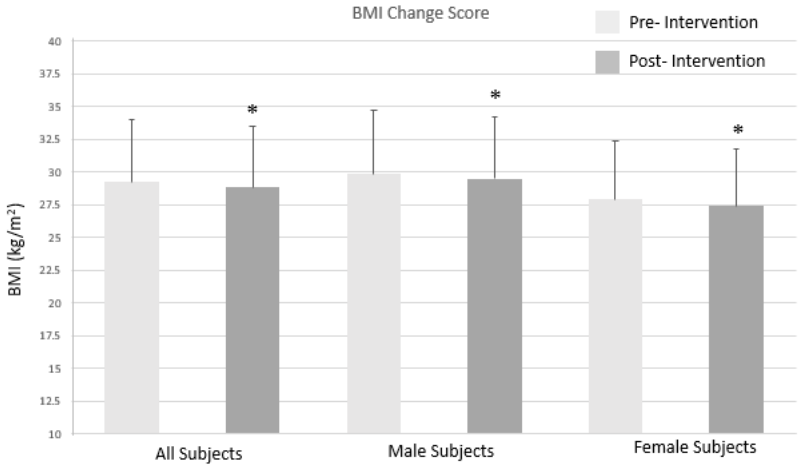
Variable	(n)	Pre weight	Post weight	Change score	p-value
Total	42	89.14 ± 17.08	87.61 ± 16.79	*****0.25 kg (0.55 lb.)	p= 0.00007
Sex					
Men	28	94.89 ± 15.61	93.50 ± 15.88	*****1.39 kg (3.0 lb.)	p= 0.00597
Female	14	77.64 ± 14.15	75.92 ± 13.83	*****1.72 kg (3.7 lbs.)	p= 0.00260

Data are means ± SD, *p<0.05

BMI results

Body mass index (BMI) was calculated for each study participant by the equation, weight (kg) divided by height (m)2. Pre-intervention BMI average was 29.21 ± 4.77 and post-intervention BMI was 28.79 ± 4.65 (decrease of 0.42) (p=0.00029). Male BMI pre-intervention was 29.86 ± 4.87 and post-BMI 29.47 ± 4.72 (p= 0.01139). Female pre-BMI was 27.9 ± 4.43 and post-BMI 27.4 ± 4.35 (p= 0.00394).

Figure 3. BMI results



Data are means ± SD, *p<0.05

Vitals analysis

Resting blood pressure was recorded through self-reporting. Pre-intervention systolic was recorded 121.04 ± 13.48 and post 119.83 ± 8.13 (p=0.4486). Pre-intervention diastolic values was recorded 76.28 ± 8.13 and post 74.42 ± 6.77 (p=0.1887). An average change of 2mmHg was recorded but to meet clinical significance for both systolic and diastolic changes it must be > 3mmHg. Therefore, neither systolic or diastolic changes were statistically or clinically significant. (Results not shown).

Discussion

Firefighters place their lives on the line for civilians every day. They are presented with physically, mentally, and emotionally daunting tasks that can cause physical harm, sleep deprivation, increased stress, and a significant decline in mental health leading to depression and suicide. The physical toll that firefighters experience involves running, crawling, and climbing in extreme heat and in dangerous situations. The common perception of a firefighter is that they are in pristine health. However, several studies and surveys have shown this to be untrue. In fact, amongst the fire community the obesity rates range from 32-40% with a combination of overweight/obese being 77-90%[12]. Along with the obesity rates being higher than expected in this population was the outstanding percentage of firefighters with hypertension. In a 2020 study examining the number of individuals classified as having HTN in the fire service resulted in 69% (n=5,337) and only 17% reported taking antihypertensive medication [20]. When you combine HTN, obesity, and hyperlipidemia together these are the three main risk factors for cardiovascular disease, all of which are prevalent amongst the firefighter population. It unfortunately comes as no surprise that nearly half of on-duty deaths were related to cardiovascular events, such as heart attack, stroke, or heart failure [2].

It is well-established that a healthy diet and consistent exercise are beneficial for cardiovascular disease and blood pressure reduction. These two lifestyle variables are better together than either alone. It is also well-established that management of blood pressure with only diet and exercise takes longer to achieve the desired reductive effects than that of anti-hypertensive medication, typically seeing a response over the span of two-to-three months. This timeframe is speculated to be longer in the firefighter population, who experience the daily barriers of stress, injury, and sleep deprivation that impede blood pressure optimization. Although the results of this study did not demonstrate a statistically significant drop in blood pressure, it should be considered that the duration of this intervention (six-weeks), in a high-demanding occupational population, plays a limiting factor. Also, blood pressure improvement is often asynchronous with changes in exercise and dietary changes. Meaning, blood pressure does not precede nor simultaneously improve with these lifestyle interventions, but rather succeeds weight loss secondary to diet and exercise

intervention at variable timeframes. Furthermore, significant weight loss and improved nutrition knowledge was observed through this study, indicating the platform and intervention was successful and if carried out over a longer duration of time, a likely beneficial and significant impact on blood pressure would result.

On-duty firefighters are subject to varying amounts of downtime at the station in between calls, which tends to be divided into cooking, cleaning, sleeping, exercising, and other leisure activities. By utilizing an already popular and user-friendly application like Instagram to promote healthy lifestyle habits and nutrition education to this population was the focus of the study. While IG is an effortless outlet to receive information, there is concern for abuse of this platform in spreading misinformation about exercise programs, diets, and supplements for monetary and/or personal gain. This study was presented as a tool to do the exact opposite. With exposure to trusted, evidence-based nutrition and exercise information, this study demonstrated that firefighters could achieve positive health results that overtime help combat cardiovascular disease.

Along with the quantitative results showing that after six-weeks of being exposed to healthy cooking recipes, fun exercises, nutrition packed visuals, and tips/tricks to losing weight through a balanced approach, qualitative data was collected. 98% of study participants reported they learned something new about nutrition from the IG page and 95% reported that the IG page was helpful in learning new and complicated nutrition related information.

Many challenges to the study occurred, mostly secondary to the global SARSCoV2-19 pandemic ("Covid-19"). The original study design was a 3-month intervention with baseline and post serum sample collection to detect changes in Hemoglobin A1C (as an indicator of glucose control) and cholesterol levels (as a biomarker of CVD risk). Unfortunately, because of COVID-19 and University-related concerns, this type of study design was deemed no longer feasible. Therefore, the study turned to be one that could be delivered online or over a smartphone and were a decentralized group of participants could be engaged. In terms of study limitations for this study, a larger sample size may yield stronger data, having ability to test blood biomarkers might prove useful, measuring engagement time on the educational materials shared via the platform also seems worthy to learn.

There is ample interest and health outcome reasons for follow-up and further studies to help determine can health modification be delivered in an engaging easy to use, dedicated social media format. Suggestions for future studies would include the original study design endpoints, nutrition knowledge, weight, body composition, A1C, total cholesterol (LDL, HDL, and triglycerides), and skinfolds. A 3-month timeline should be the minimum to see true change in weight, blood pressure, and serum marker levels.

Conclusions

The results of the study demonstrated that evidenced based nutrition content through a social media platform may be beneficial for this population by promoting positive behavior changes with food and physical activity along with increased nutrition knowledge possibly decreasing the likelihood of developing or worsening risk factors associated with cardiovascular disease. More research is needed for optimizing or improving the health of firefighters/first responders with using social media as a delivery system.

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