METHODS: Twenty-six male swimmers (age 21±2.8 years, body mass 78.3±6.7 kg) who are from China national swimming team participated in this study. Participants performing three kick start trials on the Performance Analysis System for Swimming (9691A, Kistler), the trials with the best result over 15m were included in the analysis. The force platforms (500Hz) were used to measure reaction forces exerted by front leg, rear leg and hands, respectively. The high-speed camera recorded block motion of kick start at 100Hz. The force and video were synchronized by recording the light of the synchronizer at the start signal. Two-dimensional video analyses of the block phase were used to calculated joint angle and angular velocity (hip joint, front knee joint and rear knee joint).
RESULTS: The front knee joint initial angle is 142.8±9.2°, and minimum angle is 103.5±7.8°. The near knee joint initial angle is 87.53±8.39°. The horizontal impulse of grab, forelegs and hind legs are 0.6 ± 0.21Ns·BM^{-1}, 1.63 ± 0.28Ns·BM^{-1} and 2.81 ± 0.22Ns·BM^{-1} respectively. The vertical impulse of grab, front legs and rear legs are - 2.06 ± 0.63Ns·BM^{-1}, 5.51 ± 0.77Ns·BM^{-1} and 3.05 ± 025Ns·BM^{-1} respectively. The maximum ground reaction force of front plate is produced when the front knee joint angle is 107.6°, the ground reaction pike force of rear plate is produced when the rear knee joint angle is 99.2°.
CONCLUSION: This study revealed that the front and rear legs in the kick start play a different role. If there is a swimmer who has a slow horizontal take-off velocity, the coach should emphasize force production the rear leg. The vertical impulse from the front foot was dominant for generating the vertical take-off velocity. In the process of lower limb strength training, we should not only pay attention to the production of impulse, but also emphasize the plyometric contraction of muscle.

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The Level Of Physical Activity And Their Associations During Covid 19 Outbreak In Sri Lanka

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PURPOSE: WHO has instructed to minimize social gathering and activities to control spread of COVID 19 among public. Following that Sri Lanka imposed island wide curfew as a lock down mechanism during the early phase of COVID 19 pandemic. A cross sectional study was conducted among residents of Kurunegala urban area to explore the changes in physical activities during lock down period.
METHODS: Data collection was done using telephone survey. Physical activity levels were calculated using the culturally validated version of short International Physical Activity Questionnaire (IPAQ).
RESULTS: Percentage of participants engaged in moderate amount of physical activity was 46%. At the lock down period this percentage has significantly decreased to 1.5 %($p<0.01$). Before lock down period 44% were engaged in mild physical activities andthis has increased significantly to 84% ($p<0.01$).There were no significant changes in the proportions engaged in high amount of physical activities. Mean time of sedentary activities was 21.7 hours per week during lock down period. This was a significant increase ($p<0.05$) when compared to mean hours of 18.4 , which was the mean sedentary time per week before lockdown due to COVID 19. The main reasons for changes in activity levels were lack of facilities/ space(64%) and lack of proper knowledge to engage in exercises on limited spaces without a trainer(51%).
CONCLUSIONS: Maintaining physical activity level is deficient during disasters like disease outbreaks. As a solution Physical activity schedules that require minimum space and facilities should be promoted among general public.

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Sex Differences In Body Composition Change In College Athletes During The Covid-19 Lockdown

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PURPOSE: To assess how weight, muscle mass, and fat mass changed in collegiate athletes while they were prohibited from using on-campus athletic facilities due to the COVID-19 pandemic.
METHODS: Body weight, fat mass, and muscle mass were measured using bioelectrical impedance analysis as part of routine care for 77 collegiate athletes (n=43 male, n=34 female) pre-lockdown (Jan 2020) and shortly after their return to on-campus training (Augt/Sept 2020). Pre- and post-lockdown body composition data were analyzed using linear mixed models (SAS 9.4) including effects of time, sex, and time x sex interaction. Results are presented as difference in lsmeans ± SE from the linear mixed model.
RESULTS: A significant time x sex interaction was observed for changes in fat mass during the COVID-19 lockdown ($p = 0.0018$). Fat mass significantly decreased in male athletes (-1.6 ± 0.73 lbs, $p = 0.027$) whereas fat mass increased in female athletes (1.9 ± 0.82 lbs, $p = 0.022$). There were no significant main effects of time or time x sex interactions for changes in body weight or muscle mass.
CONCLUSIONS: These data demonstrate potential sex differences in fat mass changes among college athletes during a mandatory absence from on-campus athletic facilities and in person support from coaching and performance staff. Future research should determine whether female and male athletes engaged in different dietary and physical activity behaviors during the COVID-19 pandemic. Such research may help to develop sex-specific strategies for maintaining optimal body composition and athletic performance during extended breaks from structured athletic training.

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Longitudinal Changes In Athletic Performance In Figure Skaters

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PURPOSE: To measure changes in strength, power, and agility over consecutive seasons based on competition level in competitive figure skaters.
METHODS: A total of 197 competitive singles figure skaters completed combines with United States Figure Skating on two consecutive seasons between 2011-2018. Skaters either remained in the same competitive on-ice level or increased by one level on consecutive seasons. All athletes completed the hexagon agility test, maximal vertical jump, timed tuck jumps, push-ups, and bent knee v-ups. Repeated-measures analyses of variance separated by sex with Tukey's post hoc were performed for each dependent variable and Cohen's *d* effect sizes were calculated for all significant differences.
RESULTS: Female skaters (n=65) who remained in the same level demonstrated improved performance on vertical jump ($P<0.001$, $d=0.54$), timed tuck jumps ($P=0.02$, $d=0.32$), v-ups ($P=0.005$, $d=0.29$), and hexagon jump ($P<0.001$, $d=-0.55$). There was an interaction for female skaters who remained in the same level ($P=0.04$), with senior and junior levels outperforming intermediate level skaters on the hexagon jump test ($d=0.46$-0.76). Female skaters who increased level (n=99) demonstrated improved performance on the vertical jump ($P=0.002$, $d=0.31$), hexagon jump ($P<0.001$, $d=-0.45$), and tuck jump ($P=0.012$, $d=0.35$). Male skaters (n=33) did not demonstrate any changes in performance except v-ups ($P=0.03$, $d=0.49$) for those who increased level.
CONCLUSIONS: The greatest changes were in lower level female skaters who remained in the same level, supporting the importance of participating in strength and conditioning programs earlier in skating careers to maximize athleticism before reaching the senior level, when changes in off-ice performance plateau.

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Anthropometric Changes In Female Collegiate Athletes Apparent Within Four Weeks Of A Yoga Intervention

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Many college students experience weight gain prior to graduation. Causes, consequences, and interventions have been widely published, but there are fewer examinations of athletic populations.
PURPOSE: To evaluate the effect of a structured yoga intervention on anthropometric characteristics of female collegiate athletes.
METHODS: We enrolled 14 female athletes (age 18-22) who compete in track, field, and cross country at a D1 university into a yoga intervention. We randomly assigned 7 subjects to the exercise group, involving 60 minutes of in-person guided yoga twice weekly; the other 7 served as controls. All subjects underwent baseline testing and completed follow-up testing 4 weeks

later. Using the Fit3D body scanning system (Fit3D Inc., USA), we recorded body fat percentage, waist circumference, hip circumference, and waist-to-hip ratio. Paired-samples t-tests evaluated group changes from baseline to follow-up; independent-samples t-tests compared values between the intervention and control groups.
RESULTS: Across the total sample, at baseline, body fat percentage was 25.3±4.4%, waist circumference was 31.6±2.5 inches, hip circumference was 38.8±2.7 inches, and waist-to-hip ratio was 0.80±0.04. There were no differences between the intervention and control groups in body fat percentage (p=0.905), waist circumference (p=0.133), hip circumference (p=0.239), or waist-to-hip ratio (p=0.653). At follow-up, trending differences were observed between groups in body fat percentage (p=0.073), waist circumference (p=0.080), and hip circumference (p=0.057). In the yoga intervention, paired-samples t-tests found significant reductions in waist circumference (p=0.021) and waist-to-hip ratio (p=0.020). In the control subjects, significant increases were detected over time in body fat percentage (p=0.017), waist circumference (p=0.036), and hip circumference (p=0.002).
CONCLUSIONS: After only 8 sessions of twice-weekly guided yoga, female collegiate athletes experienced improvement in waist circumference and waist-to-hip ratio. What may be more important is the apparent protective effect of the program against a tendency to increase body fat percentage, waist circumference, and hip circumference, as was observed in the control subjects.

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Influence Of Dance And Multisport Participation On Functional Movement Screen Compared To Single Sport Athletes

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PURPOSE: Functional movement capabilities are defining factors in athletic performance and possible predisposition for injury. Previous literature identifies sport and age-related normative values for FMS scores but has not examined differences between single sport, multisport, and multisport athletes who also participate in dance. Dance requires postural control, equilibrium maintenance, and stabilization along with synchronization of movement that may benefit athletes completing the FMS. The hypothesis for this study was that FMS subcategory and composite scores would differ between the three previously mentioned groups.
METHODS: Cross-sectional design investigating 25 female high school aged (14-18 years old) athletes and the impact of dance and multisport participation on FMS compared to single sport athletes. Subjects included 10 single sport volleyball players, 9 multisport athletes, and 6 multisport athletes that included dance. Differences for composite and subcategory scores among the three groups were assessed for statistical significance ($p < 0.05$) via one-way ANOVA and post-hoc analysis to identify specific differences between groups.
RESULTS: One-way ANOVA revealed statistical significance between three groups on the inline lunge (p=0.014), active straight leg raise (p=0.006), trunk stability push up (p=0.018), and total score (p=0.028). Post hoc analysis revealed statistical significance between single sport and multisport athletes on the inline lunge (p=0.012) and total score (p=0.034). Statistical significance was found between multisport athletes and dancers on the active straight leg raise (p=0.005) and between single sport athletes and dancers on the trunk stability push-up (p=0.032).
CONCLUSIONS: This study identified that participation in multiple sports and dance influences performance related to motor control, functional patterning, and overall outcomes compared to single sport athletes. These findings can provide insight for professionals working with this population to consider the role that dance and participation in a variety of sports may have on motor development of the adolescent athlete from an educational, intervention, and performance perspectives.

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Using The Functional Movement Screen™ To Predict In-Season Injuries Of Division III Collegiate Volleyball Players

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Volleyball (VB) participation has increased over the years, and thus, injury rates have also increased (Agel et al., 2007). The Functional Movement Screen™ (FMS) has been used to identify functional movement limitations and imbalances that might predispose an athlete to injury (Bonazza et al., 2016; Cook, 2010; Lehr et al., 2013) however, few studies have included VB players.
PURPOSE: To assess the functional movements and balance of collegiate VB players and to determine if the occurrence of injury during a season could have been predicted from a player's FMS score.
METHODS: Division III collegiate female VB players ($N = 22$; $M \pm SD$, Age: 19.5 ± 0.9 yrs) completed the FMS and Y Balance Test (YBT; Plisky et al., 2009) prior to the competitive season. During the season injuries that resulted in missed practice/competition were recorded by the athletic trainer at the time of the injury. To compare the injured ($n = 10$) and non-injured ($n = 12$) athletes one-way ANOVAs were calculated for FMS and YBT scores. To determine a FMS threshold score for injury occurrence, 2 × 2 contingency tables were constructed for FMS scores 13 to 18. From table data injury prediction statistics were calculated: 1) sensitivity (true +/+ test); 2) specificity (true - / - test); 3) odds ratios (strength of the association between FMS cut-off score and injury risk); 4) predictive values (% of + or - tests that correctly identify a player with or without an injury).
RESULTS: There were no significant differences between the preseason FMS composite scores of injured VB players vs. non-injured players ($M \pm SD$: 15.5 ± 1.4 and 15.7 ± 2.5). A score of 15 maximized both sensitivity (0.40) and 1-specificity (0.17) with predictive values of 67% and 63% for positive and negative tests, respectively. Odds ratio indicated that athletes who had a FMS composite score of ≤ 15 had 3.3 greater odds of becoming injured. There were no significant differences between the injured and the non-injured groups when comparing dominant and non-dominant leg YBT composite scores ($p = .34$, $p = .33$) or reach differences in the anterior, posteromedial, and posterolateral directions ($p = .38$, $p = .33$, $p = .46$), respectively.
CONCLUSION: Athletes with an FMS composite score of ≤15 in this small sample of Division III collegiate female VB players had a higher risk of becoming injured than those with scores > 15.

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Vascular Adaptation In Athletes Of Different Events

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The existence of "athlete's heart" is generally accepted, but the question of whether athletes exhibit vascular adaptation has not been fully addressed.
PURPOSE: Investigated the indexes of arteries to determine whether arterial adaptations induced by exercise exist.
METHODS: Examined the arteries of the dominant (D) and nondominant (ND) limbs of athletes and inactive subjects by duplex ultrasound.
RESULTS: 1. In tennis athletes, IMT-to-lumen of arteries were lower than controls (***carotid*** D: 0.013±0.003 vs. 0.015±0.003, ND: 0.013±0.002 vs. 0.015±0.003; ***brachial*** D: 0.026±0.002 vs. 0.039±0.011, ND: 0.038±0.009 vs. 0.042±0.013; $p<0.05$). We found larger cross-sectional area of brachial artery (D: 20.96±1.79 mm^2) relative to the ND side (16.72±0.93 mm^2, $p<0.05$) and both sides of controls (D: 13.37±0.92 mm^2, ND: 13.37±0.85 mm^2; $p<0.05$). 2. Football athletes demonstrated lower IMT-to-lumen compared with controls (***carotid*** D: 0.013±0.002 vs. 0.015±0.003, ND: 014±0.003 vs. 0.015±0.003; ***brachial*** D: 0.031±0.009 vs. 0.039±0.011, ND: 0.034±0.010 vs. 0.042±0.013; ***radial*** D: 0.075±0.014 vs. 0.089±0.018, ND: 0.087±0.027 vs. 0.106±0.021; ***femoral*** D: 0.013±0.003 vs. 0.016±0.006, ND: 0.013±0.004 vs. 0.017±0.005; $p<0.05$). We found larger cross-sectional area of femoral artery (D: 42.59±1.88 mm^2) relative to the ND side (36.70±1.75 mm^2, $p<0.05$) and D side of controls (34.87±1.50 mm^2, $p<0.05$). 3. Swimmers demonstrated lower IMT-to-lumen compared with controls (***carotid*** D: 0.013±0.003 vs. 0.015±0.003, ND: 0.014±0.002 vs. 0.015±0.003; ***brachial*** D: 0.028±0.004 vs. 0.039±0.011, ND: 0.033±0.006 vs. 0.042±0.013; ***radial*** D: 0.071±0.021 vs. 0.089±0.018, ND: 0.085±0.019 vs. 0.106±0.021; ***femoral*** D: 0.013±0.002 vs. 0.016±0.006, ND: 0.014±0.003 vs. 0.017±0.005; $p<0.05$). The cross-sectional area of brachial (D: 17.36±0.90; ND: 16.83±0.67 mm^2) and femoral arteries (D: 41.33±1.63; ND: 39.05±1.28 mm^2) were larger than controls (***brachial*** D: 13.96±0.95 mm^2, ND: 13.37±0.85; ***femoral*** D: 34.87±1.50 mm^2, ND: 34.55±1.62 mm^2; $p<0.05$).
CONCLUSION: The results suggest that "athlete's artery" has a systemic decreased wall thickness and a localized increased lumen area. These structural changes of artery are adaptations to exercise.
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