NR. 241 OP-11-006 BEWEGUNG IM KINDES- UND JUGENDALTER

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Welche Interventionen fördern Bewegung und Fitness bei Grundschulkindern? Ergebnisse eines Scoping-Reviews im Rahmen des ACTIPROS-Projekts

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› **Hintergrund:** Bewegungsmangel im Kindesalter führt zu nachhaltigen gesundheitlichen Beeinträchtigungen über die gesamte Lebensspanne. Über uni- und multimodale Interventionen in verschiedenen Settings wird versucht, die Bewegung und Fitness von Kindern frühzeitig zu fördern. Ziel der vorliegenden Studie ist es, mittels eines internationalen Scoping Reviews erfolgsversprechende Interventionen, die über das Schulsetting implementiert werden können, zu identifizieren.
› **Methode:** Es wurde ein Scoping Review nach der Arksey und O´Malley´s Methode durchgeführt. Durch eine systematische Literaturrecherche ergab N=3166 relevante wissenschaftliche Beiträge. Nach Abstract- und Volltextscreening wurden n=192 Referenzen eingeschlossen, die insgesamt die Wirksamkeit von n=178 Interventionen untersuchten. Die meisten Interventionen fanden im Schulsetting statt (n=152, 85%). Wenige Interventionen nutzten dabei mehrere Settings simultan (n=21, 12%). Ein Drittel der Interventionen basierte auf einer theoretischen Fundierung (n=62, 35%). Diese zeigten häufiger positive Effekte auf die KA (n=38, 72%), SV (n=15, 81,4%) und die KF (n=16, 84,2%) als die nicht theoriebasierten Interventionen (KA: n=55, 63%, SV: n=22, 73%, KF: n=18, 39,2%). Mehrheitlich wurde nur ein Bereich des HPS Framework angesprochen (n=82, 46%). Der am häufigsten verwendete Bereich war die Kooperation mit Eltern und der Kommune (n=94, 53%).
› **Schlussfolgerung:** Die Ergebnisse dieses Scoping Reviews zeigen, dass die untersuchten Interventionen zur Förderung von Bewegung und Fitness den HPS Ansatz kaum verfolgt haben. Einzelne Bereiche des HPS Framework, wie die Kooperation mit Eltern und Kommune, sind gut erforscht, zu erfolgversprechenden Kombinationen der HPS-Bereiche besteht jedoch weiterhin Forschungsbedarf.

NR. 242 OP-12-001 KARDIOLOGISCHE ASPEKTE IM SPORT

Thouet, T[1], Fröhlich, V[1], Wolfarth, B[2]

3D-Echokardiographie mit automatisierter Konturdetektion vs 2D-Echokardiographie in der Beurteilung von Sportherzen

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› **Hintergrund:** Die 2D-Echokardiographie ist eine etablierte Methode für die Beurteilung der physiologischen Sportherzadaptation und die Abgrenzung eventuell vorhandener Pathologien bei Leistungssportlern. Die 3D-Echokardiographie erfasst das Herz als dreidimensionalen Körper, unterliegt im Vergleich zur 2D-Echokardiographie weniger geometrischer Näherungen und weist eine höhere Übereinstimmung mit dem Goldstandard, der kardialen MRT, auf. Untersucht wurde in dieser Arbeit die Anwendbarkeit der 3D-Echokardiographie des Herzens von Leistungssportlern unter Verwendung eines automatisierten und adaptiven Algorithmus im direkten Vergleich mit der bislang in der Sportmedizin vorwiegend angewendeten 2D-Echokardiographie.
› **Methode:** Es wurden Leistungssportler, die sich zur sportmedizinischen Grunduntersuchung in unserer Ambulanz vorstellten, mittels 2D-Echokardiographie nach biplanem, standardisiertem Untersuchungsprotokoll untersucht und ausgewertet. Zusätzlich wurden 3D-Volumen aufgezeichnet, die mit einem adaptiven, model-basierten und automatisiertem Algorithmus (HeartModel, Philips, The Netherlands) ausgemessen wurden. Die Parameter der linksventrikulären und linksatrialen Volumen und Funktion (LEDV, LESV, LVSV, LVEF, LAVmin, LAVmax, LAV PreA, LA EF) wurden miteinander verglichen. Eine manuelle Anpassung der durch den HeartModel-Algorithmus detektierten endokardialen Konturen wurde im Bedarfsfall von einem erfahrenen Befunder vorgenommen. Die statistische Analyse erfolgte mittels T-Test, Pearson-Korrelation, Regressionsgeraden und Bland-Altman-Plot.
› **Ergebnis:** Es wurden 219 Leistungssportler in die Untersuchung eingeschlossen (Geschlecht: 167m, 52 w; Mittleres Alter: 21 Jahre ±8; Körpergröße 179cm ±15; Gewicht 73 ± 19; BMI 22 ± 4; Trainingsstunden/Woche 17h ± 7; Sportarten: Skill: 1/0,5%, Power: 46/21%, Endurance: 60/21%, Mixed: 112/51%). Die Ergebnisse zeigen im mittel hoch-signifikante Unterschiede für die linksventrikuläre Volumen- und Funktionsbestimmung im Vergleich zwischen biplaner 2D-Bestimmung und der 3D-HeartModel-basierten Analyse (LVEDV: 142±42ml vs 206±57ml, p<0,001; LVESV: 64±21ml vs 103±31ml, p<0,001; LVSV: 78±23ml vs 103±29ml, p<0,001; LVEF: 55±4% vs 50±5%, p<0,001). Ebenfalls hoch-signifikante Unterschiede ergaben sich in der linksatrialen Analyse (LAVmin: 16±7,8ml vs 21±10ml, p<0,001; LAVpreA 25±25±11ml vs 32±14ml, p<0,001; LAVmax 44±17ml vs 56±20ml, p<0,001).
› **Schlussfolgerung:** In dieser Arbeit wurde erstmalig die 3D-Echokardiographie mit automatisierter Vermessung bei Leistungssportlern angewendet. Es zeigen sich durchgehend höhere Volumina von LV und LA im Vergleich zur 2D-Methode. Dies ist mit den publizierten Ergebnissen zum Goldstandard, der kardialen MRT, vereinbar. Die 3D-Echokardiographie mit automatisierter Vermessung eignet sich somit möglicherweise für eine exaktere Bestimmung und Beurteilung sportphysiologischer Anpassungen im Vergleich zur 2D-Methode.

NR. 243 OP-12-002 KARDIOLOGISCHE ASPEKTE IM SPORT

Blume, K[1], Wolfarth, B[2]

Gewöhnliche und ungewöhnliche EKG-Veränderungen im Längsschnitt

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› **Hintergrund**: Zur Detektion von Risikogruppen bezüglich des Plötzlichen Herztodes wurden zahlreiche Forschungsarbeiten initiiert. Mithilfe ausgegebener Handlungsempfehlungen konnte die Differenzierung zwischen physiologischen Anpassungserscheinungen und pathologischen Veränderungen verbessert werden. Bisher basieren die Daten vorwiegend auf Querschnittsanalysen. Daher war es Ziel, die Prävalenz von EKG-Veränderungen in einem Leistungssportkollektiv longitudinal zu untersuchen.
› **Methode**: Dazu wurden jeweils 3 EKGs (V1: 17,2 ± 4,2 J., V2: 20,3 ± 4,2 J., V3: 22,9 ± 4,5 J.) von 194 LeistungssportlerInnen (m: 140, w: 54) sechs verschiedener Sportarten standardisiert in Anlehnung an die ESC- und Seattle-Kriterien analysiert und die Prävalenzen gewöhnlicher und ungewöhnlicher EKG-Veränderungen bestimmt.
› **Ergebnisse**: Insgesamt betrug die Beobachtungszeit 5,6 ± 1,5 Jahre (MIN 3,2 J., MAX 9,1 J.). Zum Zeitpunkt V1 wiesen 68,6 % aller AthletInnen mindestens eine gewöhnliche EKG-Veränderung auf. Die Prävalenz erhöhte sich zu V2 auf 80,4 % und zu V3 auf 83,5 % (p < 0,001). Trotz vergleichbaren Alters, zeigten sich keine Prävalenzunterschiede zwischen den Geschlechtern (V1: p = 0,297, V2: p = 0,865, V3: p = 0,410). Als häufigste gewöhnliche EKG-Veränderungen fanden sich die Sinusbradykardie (V1: 36,1 %, V3: 60,3 %) und Early Repolarization (V1: 36,1 %, V3: 39,7 %). Nur die Sinusbradykardie zeigte im Längsschnitt eine signifikante Zunahme der Prävalenz (p < 0,001). Die Prävalenz ungewöhnlicher EKG-Veränderungen erhöhte sich von 14,9 % (V1) auf 19,6 % (V2) und schließlich 23,2 % (V3, p = 0,023). Es lagen maximal zwei ungewöhnliche EKG-Veränderungen gleichzeitig vor (V1: 0,5 %, V2: 0,5 %, V3: 1,0 %). Geschlechtsunterschiede der Prävalenzen waren weiterhin nicht ersichtlich (V1: p = 0,067, V2: p = 0,524, V3: p = 0,086). Als häufigste ungewöhnliche EKG-Veränderungen zeigten sich eine verkürzte QTc-Zeit (6,7 %) und T-Negativierungen (2,6 %), deren Auftreten im Verlauf abnahmen (V3: 2,1 % bzw. 4,1 %). Alle anderen Veränderungen erreichten maximal eine Prävalenz von 1,5 %. Mit Ausnahme der linksatrialen Vergrößerung (p = 0,004), waren keine signifikanten Prävalenzanstiege longitudinal ersichtlich.
› **Schlussfolgerung**: Zum Zeitpunkt V1 lag bei annähernd 70 % aller AthletInnen mindestens eine gewöhnliche EKG-Veränderung vor, deren Prävalenz mit Zunahme der Trainingsjahre anstieg. Deutlich seltener traten ungewöhnliche EKG-Veränderungen auf. Das Vorliegen dieser, insbesondere bei gleichzeitige Auftreten mehrerer Auffälligkeiten, bedarf einer weiteren kardiologischen Abklärung.

NR. 244 OP-12-003 KARDIOLOGISCHE ASPEKTE IM SPORT

Thouet, T[1], Becker, F[2], Klügl, M[2], Wüstenfeld, F[3], Wolfarth, B[4]

Echokardiographisches Screening zur Detektion von Koronararterienabgangsanomalien bei Leistungssportlern

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› **Einleitung**: Die DOSB-Richtlinie für Kaderathleten sieht im Rahmen der Gesundheitsuntersuchung die Durchführung einer Echokardiographie vor. Deren Ziel ist es, potenziell lebensbedrohliche Herzerkrankungen zu erkennen. Koronararterienanomalien sind die zweithäufigste Ursache für einen plötzlichen Herztod bei jungen Leistungssportlern. Inwiefern die Koronarien routinemäßig in einer sportkardiologischen Grunduntersuchung für Leistungssportler beurteilt werden könnten, ist nicht abschließend geklärt. An einem repräsentativen Athletenkollektiv sollte in dieser prospektiven Kohortenstudie evaluiert werden, inwiefern die Echokardiographie als Screeninguntersuchung für die Beurteilung der koronaren Ostien bei Leistungssportlern geeignet ist.
› **Methode**: Die Studienkohorte umfasst 872 Echokardiographien von 768 Leistungssportlern aus 56 Sportarten. Es wurden nur Athleten jünger als 35 Jahre eingeschlossen. Ihre Echokardiographien wurden von jeweils zwei Untersuchern im Hinblick auf die Darstellbarkeit der Ostien beurteilt. Anschließend wurde ein Intra- sowie ein Interobservertest zur Beurteilung der Reliabilität durchgeführt. Statistische Subgruppenanalysen sowie Einflussfaktoren auf die Darstellbarkeit der Koronarostien wurden untersucht. Alle Koronarien wurden vermessen und in ihrem Verlauf beurteilt. Anomalien wurden dokumentiert.
› **Ergebnisse**: Die Koronarostien lassen sich in etwa 90% der Fälle in der Echokardiographie sicher darstellen. Koronare Ostien waren in der Subgruppe der unter 18-jährigen und der Athleten mit einem BMI <25kg/m2 statistisch signifikant häufiger darstellbar. Die Erfahrenheit des Untersuchers war für ein untersuchtes Ostium ein signifikanter Einflussfaktor zur Darstellbarkeit. Subgruppenanalysen zum Einfluss von Geschlecht und zum Einfluss der Longitudinalverkürzung des Herzens lieferten keine signifikanten Ergebnisse. Ein Intraobserververgleich lieferte keine zufriedenstellenden Ergebnisse, was auf sich ändernde externe Untersuchungsbedingungen zurückzuführen sein kann. Ein Interobserververgleich lieferte größtenteils zufriedenstellende Werte für die Reliabilität mit Werten für Kuder-Richardson r > 0,65.
› **Diskussion**: Unsere Daten weisen darauf hin, dass ein Screeningzeitpunkt vor dem 18. Lebensjahr für eine bestmögliche Darstellung sinnvoll wäre. Die Reliabilität der Untersuchung konnte in einem Interobserververgleich als größtenteils zufriedenstellend bewertet werden. Die Echokardiographie unterliegt allgemein äußeren Einflussfaktoren. Hierzu zählt auch die Erfahrenheit des Untersuchers. Prinzipiell zeigt unsere Arbeit, dass die Echokardiographie zur Darstellung der koronaren Ostien geeignet ist. Eine Darstellung der koronaren Ostien in der Standardechokardiographie der sportkardiologischen Untersuchung sollte in Zukunft erwogen werden.

NR. 245 OP-12-004 KARDIOLOGISCHE ASPEKTE IM SPORT

Lona, G[1], Endes, K[1], Köchli, S[1], Infanger, D[1], Zahner, L[2], Hanssen, H[1]

Der Zusammenhang von körperlicher Aktivität und Fitness auf die Veränderung von kardiovaskulären Risikofaktoren und retinaler Gefässgesundheit bei Schulkindern

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› **Background**: Prevention of cardiovascular (CV) disease should start early in life. The study aimed to investigate the association of changes in physical activity, sedentary behavior and cardiorespiratory fitness (CRF) with development of body mass index (BMI), blood pressure (BP) and retinal microvascular health in children over four years.
› **Methods**: In 2014, 391 children aged 6-8 years were screened, and thereof 262 children were reexamined after four years following standardized protocols. Retinal arteriolar (CRAE) and venular diameters were measured by a retinal vessel analyzer. CRF was objectively assessed by a 20m shuttle run, physical activity and sedentary behavior by use of a questionnaire.
› **Results**: Children who achieved higher CRF levels reduced their BMI (£ [95% CI] -0.35 [-0.46 to -0.25] kg/m2 per stage, P ≤ 0.001) and thereby developed wider CRAE (£ [95% CI] 0.25 [0.24 to 0.48] µm per stage, P = 0.03) at follow-up. Moreover, children with elevated or high systolic BP at baseline, but lower levels of sedentary behavior during the observation period, had wider CRAE at follow-up (£ [95% CI] -0.37 [-0.66 to -0.08] µm per 10 min/d, P = 0.013).
› **Conclusion**: An increase of CRF over four years was associated with a reduced BMI and consequently wider retinal arterioles at follow-up. In children with elevated or high systolic BP, a reduction of sedentary behavior by merely 10 min per day significantly improved retinal microvascular health as a primary prevention strategy to promote childhood health and combat development of manifest CV disease later in life.

NR. 246 OP-12-005 KARDIOLOGISCHE ASPEKTE IM SPORT

Hauser, C[1], Lona, G[1], Köchli, S[1], Infanger, D[1], Endes, K[1], Schmidt-Trucksäss, A[1], Hanssen, H[1]

Übergewicht, Blutdruck und arterielle Gefässsteifigkeit: Ergebnisse einer Meta-Analyse

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› **Hintergrund:** Die zentrale Pulswellengeschwindigkeit (cPWV) ist ein Biomarker für das kardiovaskuläre (CV) Risiko und ein Prädiktor für CV-Ereignisse im Erwachsenenalter. Veränderungen der arteriellen Gefässsteifigkeit wurden bereits mit einem erhöhten CV-Risiko im Kindesalter assoziiert. Ziel der Studie war es, den Zusammenhang zwischen Blutdruck (BP), Body-Mass-Index (BMI) und kardiorespiratorischer Fitness (CRF) mit cPWV bei Kindern systematisch zu überprüfen und zu meta-analysieren.
› **Methoden:** Systematische Literatursuche in den Datenbanken PubMed, Web of Science, Embase und dem Register of Controlled Trials. Es wurden alle schul- und populationsbezogene Querschnittsstudien eingeschlossen.
› **Ergebnisse:** Es wurden insgesamt 9114 Studien gefunden und 53 Volltextartikel auf ihre Eignung hin analysiert. Zweiundzwanzig Artikel (9604 Kinder und Jugendliche) wurden zur Bewertung und Reflexion in der systematischen Übersicht herangezogen. Acht Artikel wurden in die Meta-Analyse eingeschlossen. Höhere systolische und diastolische Blutdruckwerte waren mit höherer cPWV assoziiert (Effektgröße (ES) 0,02 (95% CI: 0,012 bis 0,027) bzw. ES 0,02 (95% CI: 0,011 bis 0,029)). Ein höherer BMI war mit einer höheren cPWV assoziiert (ES 0,025 (95% CI: 0,013 bis 0,038). CRF war umgekehrt proportional zu cPWV assoziiert (ES -0,033 (95% CI: -0,055 bis -0,011).
› **Schlussfolgerungen:** Unsere Ergebnisse deuten darauf hin, dass ein höherer BD und BMI im Kindesalter mit einer beeinträchtigten arteriellen Gefässsteifigkeit assoziiert ist, während eine höhere CRF mit einer günstigen Gefässsteifigkeit assoziiert ist. Langzeitstudien sind erforderlich, um den prognostischen Wert der cPWV für die Entwicklung des CV-Risikos in der Kindheit und im späteren Erwachsenenleben zu untersuchen.

NR. 247 OP-12-006 KARDIOLOGISCHE ASPEKTE IM SPORT

Härtel, J A[1], Herberg, U[1], Winkler, C[1], Jung, T[1], Breuer, J[1], Müller, N[1]

Körperliche Aktivität, Herzfrequenzen und kardiopulmonale Leistungsfähigkeit bei Fontan Patienten

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› **Hintergrund**: Die körperliche Unterforderung durch einen zunehmend sitzenden Lebensstil könnte bei Patienten mit schweren angeborenen Herzfehlern, wie einem Einkammerherz, einen größeren negativen Einfluss auf die kardiopulmonale Leistungsfähigkeit im Vergleich zu Herzgesunden haben. Eine häufig vorhandene chronotrope Inkompetenz könnte Empfehlungen zu einem herzfrequenzbasierten Bewegungstraining zusätzlich erschweren und zu früherer körperlicher Erschöpfung führen. Um diese Zusammenhänge besser zu verstehen, wurden spiroergometrische Daten mit Herzfrequenz- und Aktivitätsdaten aus dem Alltag der Patienten verglichen.
› **Methode**: 21 Fontan-Patienten im Alter von 14 bis 31 Jahren und 20 in Alter, Geschlecht und BMI gematchte herzgesunde Kontrollprobanden absolvierten eine kardiopulmonale Leistungsdiagnostik auf einem Fahrradergometer. Zusätzlich wurde ein 5-tägiges Aktivitätstracking mit Herzfrequenzmessung mittels eines triaxialen Beschleunigungssensors (Actigraph wGT3x-BT) und eines optischen Pulssensors (Polar OH1) durchgeführt.
› **Ergebnis**: Es gab keine signifikanten Unterschiede in der Bewegungshäufigkeit im moderaten bis intensiven Intensitätsbereich (MVPA) zwischen Fontan-Patienten und Kontrollprobanden. 27 % der jugendlichen und 71 % der volljährigen Patienten (33 % respektive 80 % der Kontrollprobanden) erreichten die Bewegungsempfehlungen der WHO. Bei Fontan-Patienten zeigten sich signifikante Korrelationen der MVPA mit der maximalen Sauerstoffaufnahme und der Laktatkonzentration. Das Herzfrequenzverhalten zeigte keine signifikanten Unterschiede im Alltag oder bei Belastungsintensitäten bis 2 W/kg.
› **Schlussfolgerung**: Klinisch stabile Fontan-Patienten können und sollten sich regelmäßig körperlich belasten, um eine höhere Sauerstoffaufnahme zu erreichen, die mutmaßlich mit einer besseren Lebensqualität und einer verminderten Mortalität einhergeht. Bei den untersuchten Patienten stellte eine chronotrope Inkompetenz keinen limitierenden Faktor dar. Regelmäßige körperliche Belastung sollte daher in ein multimodales Behandlungskonzept miteinfließen. Ob allerdings ein moderates oder intensives Belastungstraining Vorteile zeigt, muss in Folgestudien untersucht werden. Förderung durch den „KinderHerz-Innovationspreis NRW 2016.

NR. 248 OP-13-001 COVID UND KLIMA I

Faude, O[1], Schreiber, S[2], Müller, J[2], Müller, S[2], Nebiker, L[1], Beauduoin, F[2], Meyer, T[3], Egger, F[2]

Risk of Disease Transmission during Football Matches – a Video-Based Analysis

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› **Background**: Data on the amount and nature of contacts, particularly those ones involving the risk of respiratory disease transmission during football matches is scarce. We aimed to analyze potential situations, which bear a risk for contagion during match play.
› **Methods**: We analyzed 50 matches from different levels of play (professional, amateur, youth). Two reviewers independently evaluated contacts of all players in the field of view in each match. We focused on within-player hand-to-head contacts (e.g. touching the mouth or hair, i.e. with or without contact to a mucous membrane) and between-player contacts (upper body). We categorized duels with direct contact between opponents into face-to-face and other ones and measured the duration of each contact. All videos were analyzed in real time and stopped or rewound as often as needed to capture all relevant contacts of each player. When the number of observed situations differed between reviewers, we used the higher number for analysis.
› **Results**: We observed 22,2 within-player hand-to-head contacts per player-hour with professional players showing the lowest values (16,7) and youth players the highest number (29,2) of contacts. Three quarters of these contacts occurred during breaks and 56% were mucosal contacts. We found 24,9 between-player contacts per player-hour, of which 1,2% were contacts with the head or face being involved. All other contacts referred to the arm, shoulder or core. About one third of these contacts lasted longer than 3 seconds. None of these included the head. Face-to-face contacts summed up to 2,1 per player-hour (8,4%). We found no obvious systematic differences between playing levels. Speaking directly to another player (1,9 per player-hour) and shouting (0,1 per player-hour) as well as clap-hands or hugging (1,3 per player-hour) accounted for a relatively low number of potential risk situations.
› **Conclusions**: Within-player hand-to-head contacts during football match play were in the lower range of what has been reported in the literature for daily life situations. Between-player contacts were mostly of very short duration, not face-to-face and did rarely involve the head. Our data can be used to estimate the risk of contagion in football. Financially supported by the German Football Federation (DFB).

NR. 249 OP-13-002 COVID UND KLIMA I

Egger, F[1], Faude, O[2], Schreiber, S[3], Gärtner, B[4], Meyer, T[3]

Kann man sich während eines Fußballspiels mit SARS-CoV-2 infizieren? - Eine Videoanalyse von 3 Spielen mit 18 infizierten Spielern

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› **Hintergrund**: Es ist unklar, inwieweit Kontakte während eines Fußballspiels zu einer Übertragung von SARS-CoV-2 führen können. Da es ethisch nicht vertretbar ist, „infizierte Spieler" quasi-experimentell im Rahmen einer Studie Fußball spielen zu lassen, um das Infektionsgeschehen zu beobachten, sind zur Klärung dieser Frage alternative (beobachtende) Ansätze erforderlich. Einem solchen Zweck kann die Auswertung „versehentlich" Fußball spielender infektiöser Personen (z. B. infolge verzögerter Testergebnisse oder im Rahmen gänzlich fehlender Testungen im Amateurbereich) dienen.
› **Methodik**: In einer retrospektiven Videoanalyse wurden 3 Spiele mit 18 SARS-CoV-2 positiven Spielern (pro Spiel eine betroffene Mannschaft mit infizierten Spielern) zwischen August und September 2020 auf infektionsrelevante Kontakte untersucht. Es waren professionelle, semi-professionelle, Amateur- und Jugendmannschaften vertreten. Nur Spieler, die vor dem Spiel negativ und am Spieltag bis zu 2 Tage danach positiv mit einem Nasen-/Rachenabstrich auf SARS-CoV-2-RNA getestet wurden, waren als „infektiös" eingeschlossen. Ein weiteres Einschlusskriterium war die wiederholte PCR-Testung nach den Spielen. Die Videoanalysen (Standardsicht auf Höhe der Mittellinie) erfolgten durch 2 unabhängige Untersucher.
› **Resultate**: In 3 Spielen mit 18 SARS-CoV-2 positiven Spielern (2 am Spieltag mit zu spät bekanntem positivem Test, 16 mit positivem Test nach dem Spieltag) traten keine Ansteckungen der gegnerischen Mannschaft oder der Schiedsrichter auf. Das Verhältnis zwischen infizierten und exponierten Spielern (inklusive Einwechselspieler) lag in den 3 Spielen bei 2/28 (7%), 2/20 (10%) und 14/29 (48%). Die beobachteten Zweikämpfe der infizierten Spieler dauerten nie länger als 3 Sekunden. Die Ausrichtung der Gesichter während auftretender Zweikämpfe war entweder seitlich oder hintereinander. Es wurden nur 2 frontale Kontakte beobachtet (Zusammenstoß zweier Spieler, Gespräch zwischen Schiedsrichter und Spieler < 9 Sekunden). Kontakte mit der eigenen Hand zur Gesichtsschleimhaut traten bei den 18 positiv getesteten Spielern selten auf (9,9 Kontakte pro Stunde; Median 4,0; Bereich 1,3 - 32,0). Zu einem Abklatschen der Spieler untereinander kam es ausschließlich beim Torjubel.
› **Schlussfolgerung**: Unsere Befunde weisen darauf hin, dass das Infektionsrisiko für SARS-CoV-2 während eines Fußballspiels gering ist. Die Zahl der auftretenden Risikosituationen für die Übertragung respiratorischer Viren wird möglicherweise überschätzt. Auch unter realen Spielbedingungen könnte eine realistische weitere Reduktion der Übertragungsgefahr in geänderten Verhaltensweisen beim Torjubel liegen.
› *Die Studie wurde durch den Deutschen Fußball Bund finanziert.*

NR. 250 OP-13-003 COVID UND KLIMA I

Kemmler, W[1], von Stengel, S[2]

COVID-19 Induzierte „Detrainings-Effekte" nach 13 monatiger Trainingsintervention bei frühpostmenopausalen Frauen mit einer Osteopenie

1. UNIVERSITÄT ERLANGEN-NÜRNBERG
2. FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG, *Institut für Medizinische Physik und Mikrogewebetechnik*

› **Hintergrund**: Zeitweilige Unterbrechungen eines körperlichen Trainings bei gleichzeitiger Aufrechterhaltung der habituellen körperlichen Aktivität ist ein häufiges Phänomen in der sportlichen Biographie von Erwachsenen. Insbesondere der im März 2020 verhängte COVID-19 induzierte „Lock-down" für Indoor-Sportprogramme über ca. 3 Monate ist eine Blaupause für die Auswirkungen abrupt beendeter, supervisierter Trainingsprotokolle im Gruppenrahmen bei gleichzeitiger Aufrechterhaltung von körperlicher Aktivität und individuellem Sporttreiben. Ziel der vorliegenden Studie war es, die Auswirkungen einer 3-monatigen Trainingspause („Detraining") auf muskuloskeletale Größen nach einem 13-monatigen intensiven Körpertraining bei osteopenischen Frauen in der frühen Postmenopause zu evaluieren.
› **Methode**: Aufgrund der COVID-19-Pandemie mussten wir die 18-monatige randomisierte, kontrollierte ACTLIFE-Trainingsintervention unmittelbar nach der 13-Monats Follow-up Kontrollmessung vorzeitig beenden. Während die dreimal wöchentlich durchgeführten hochintensiven Ausdauer- und Krafttrainingseinheiten der Übungsgruppe (TG: n=27) und das einmal wöchentlich durchgeführte niedrigintensive Trainingsprogramm der Kontrollgruppe (KG: n=27) Mitte März 2016 ein abruptes Ende fand, blieben individuelle Aktivitäten im Freien zugelassen. Endpunkte der Studie waren die fettfreie Körpermasse (LBM) und die Knochenmineraldichte (BMD) an der Lendenwirbelsäule (LS) erfasst mittels DXA-Methode, die maximale Hüft-/Beinextensionskraft evaluiert mittels isokinetischer Beinpresse sowie die maximale Sprungkraft (Leistung) gemessen mittels Kraftmessplatte.
› **Ergebnisse**: Keine der Teilnehmerin gab an, in der 3-monatigen Lock-down Phase ein kraft- oder stabilitätsorientiertes Training durchgeführt zu haben. Während die Teilnehmerinnen beider Gruppen berichteten die habituelle körperliche Aktivität aufrecht erhalten zu haben, stieg das Volumen ausdauerorientierter sportlicher Inhalte (schnelles Gehen, Nordic Walking, Jogging, Radfahren) in beiden Gruppe um ca. 40% an. „Detraining-induzierte" Verringerungen der LBM und der maximalen Hüft-/Beinextensionskraft sowie der Sprunghöhe, nicht aber der BMD-LS waren in der Trainings- verglichen mit der Kontrollgruppe signifikant ausgeprägter. Signifikante trainingsinduzierte Effekte, die nach 13 Monaten Trainingsdauer für LBM, BMD und Kraftfähigkeiten nachgewiesen wurden, reduzierten sich nach 3 Monaten Detraining für LBM und BMD-LS auf ein nicht-signifikantes Niveau, während der Effekt für Kraft (p<.001) und Leistung (p<.001) auch nach signifikanter Reduktion hochsignifikant verblieb.
› **Schlussfolgerung**: Eine dreimonatige Unterbrechung eines supervisierten intensiven Trainings der Kraft- und Ausdauer führt trotz Aufrechterhaltung der habituellen Aktivität und Steigerung niedrigintensiver aerober Belastungsreize zu einem kompletten oder nahezu kompletten Verlust (LBM, BMD) der vorher erworbenen, trainingsinduzierten Effekte. Als Konsequenz sollten Trainingsprogramme für Erwachsene kontinuierlich oder zumindest ohne längere Unterbrechungen durchgeführt werden.

NR. 251 OP-13-004 COVID UND KLIMA I

Carlsohn, A[1], Adam, S[2], Rossi, C D[1], Riedel, N[1]

Auswirkungen der COVID-19 bedingten Einschränkungen auf die Verpflegung von Athlet*innen an Einrichtungen des Deutschen Spitzensports

1. HAW HAMBURG/FAKULTÄT LIFE SCIENCES
2. HAW HAMBURG, *Fakultät Life Sciences*

› **Hintergrund:** Für die Verpflegungsangebote an Einrichtungen des Deutschen Spitzensports sind fundierte Qualitätskriterien verfügbar, um eine gesundheitsförderliche und bedarfsgerechte Ernährung für Spitzensportler*innen in Deutschland trotz heterogener Ernährungsbedarfe zu gewährleisten. Insbesondere für jüngere Athlet*innen ist eine unzureichende Ernährungskompetenz bereits gezeigt worden. Ziel der Erhebung war die Untersuchung der Auswirkungen der COVID-19 bedingten Einschränkungen in 2020 auf die Verpflegungssituation von Athlet*innen an Einrichtungen des Deutschen Spitzensports.
› **Methode:** Im Zeitraum 04-09/2020 wurden insgesamt 357 Wettkampfsportler*innen in einem Online-Survey u.a. zum Ernährungs- und Trainingsverhalten während der COVID-19 Eindämmungsmaßnahmen befragt. Die Ergebnisse von 72 Athlet*innen (28±12 Jahre; 54% weiblich), die vor April 2020 regelmäßig an der Gemeinschaftsverpflegung in Häusern der Athleten (HdA), Eliteschulen des Sports (EdS) oder in Bundesleistungszentren (BLZ) teilnahmen, wurden deskriptiv (mean ± SD, N) und hypothesenprüfen (α=0.05) ausgewertet.
› **Ergebnisse:** Die Häufigkeit der Verpflegung in Einrichtungen des Deutschen Spitzensports sank während der COVID-19 bedingten Einschränkungen signifikant. In HdA (N=31 Athlet*innen) wurden während der Einschränkungen pro Woche im Mittel 1,9±5,2 Mahlzeiten verglichen mit 3,7±6,4 Mahlzeiten zuvor eingenommen (p=0,027). In EdS (N=29) wurden keine Mahlzeiten während der Einschränkungen (0±0 vs. 1,2±3,1; p=0,038) verzehrt. In BLZ (N=23) wurden keine statistischen Veränderungen beobachtet (0±0 vs. 0,1±0,6; p=0,328). Befragt nach den positiven Veränderungen nannten Athlet*innen insbesondere den höheren Zeiteinsatz zum Zubereiten von Mahlzeiten (N=17), eine individuell abgestimmte und organisierte Ernährung (N=7) sowie eine bewusstere bzw. gesündere Ernährungsweise (N=6). Als Nachteile wurden erhöhte Verzehrmengen durch Langeweile und/oder aus Frust (N=11), unregelmäßige Mahlzeiten (N=4), ein höherer Zeitaufwand (N=4) und die Eigenverantwortung über die Ernährung (N=5) genannt.
› **Schlussfolgerung:** Von den COVID-19 bedingten Einschränkungen waren in erheblichem Maß auch Verpflegungsangebote an Einrichtungen des Deutschen Spitzensports betroffen. Nicht allen Athlet*innen gelang es, sich individuell gut zu organisieren und eine bewusstere, selbstverantwortliche Ernährung in den Alltag zu integrieren. Unterstützungsbedarf im Sinne einer Steigerung der Ernährungskompetenz (inkl. Planung und Inanspruchnahme sportgerechter Außer- Haus-Verpflegung) besteht möglicherweise insbesondere bei jüngeren Athlet*innen an den EdS.

NR. 252 OP-14-001 GERMAN MOL. EXERCISE PHYS. GROUP

Krämer-Albers, E[1], Brahmer, A[2], Neuberger, E[3], Simon, P[2]

The extracellular Vesicle Landscape in exercising Humans

1. UNIVERSITY OF MAINZ, *Institute of Developmental Biology and Neurobiology*
2. DEPARTMENT OF SPORTS MEDICINE, *University of Mainz*
3. UNIVERSITY OF MAINZ, *Department of Sports Medicine*

› **Background**: Physical activity triggers acute physiological changes, including the release of extracellular vesicles (EVs) into the circulation, promoting enhanced tissue crosstalk. EVs represent versatile entities with body-wide signalling functions as they may pass barriers and deliver complex biomolecules between cells and tissues. Different exercise modalities induce the liberation of diverse EV subpopulations and it has been suggested that EVs released during exercise (ExerVs) contribute to the manifold protective effects associated with exercise. An in-depth molecular characterisation of ExerVs (release kinetics, cellular origin, cargo and functions) is key to reveal the potential role of EVs in exercise-related benefits for physical and mental health.
› **Methods** : EVs were isolated from blood plasma collected before, during (RER ~0.9), immediately after, and 30 to 90 min recovery after an exhaustive bout of exercise using differential ultracentrifugation, size-exclusion chromatography, or immuno-affinity capture. ExerV dynamics were revealed by Nanoparticle tracking analysis (NTA) and western blotting (WB) and phenotyping was performed using multiplexed analysis methods targeting a variety of characteristic surface epitopes on EVs. Concentrations of total circulating cell-free (cf) DNA and ExerV-associated cfDNA were measured by qPCR.
› **Results**: Overall EV-levels were increasing during incremental exercise in a load-response related fashion. Phenotyping of the EV-subtypes revealed that ExerVs are derived from leukocytes, including lymphocytes (CD4+EVs, CD8+EVs), monocytes (CD14+cEVs) and antigen-presenting cells (MHCI+EVs, MHCII+EVs), as well as endothelial cells (CD105+EVs, CD146+EVs) and platelets (CD41b+EVs, CD62P+EVs). The proportion of cfDNA associated with ExerVs was <1%.
› **Conclusion**: Different cell types of the circulatory system, which are related to immune regulation, cardiovascular functions and regeneration, contribute to the release of ExerVs into blood. cfDNA release during exercise occurs independent of EVs. Further examination of ExerV subtypes, their target cells and functions will unravel the role of ExerVs in post-exercise signalling with prospects for the prevention of life-style disease.

NR. 253 OP-14-002 GERMAN MOL. EXERCISE PHYS. GROUP

Dyar, K[1], Sato, S[1], Dyar, K[2,3], Treebak, J T[4], Linde Basse, A[4], Schönke, M[5], Chen, S[6], Samad, M[6], Baldi, P[6], Lutter, D[3,7], Zierath, J R[4,5,8], Sassone-Corsi, P[1]

Atlas of Exercise Metabolism Reveals Time-Dependent Signatures of Metabolic Homeostasis

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3. METABOLIC PHYSIOLOGY, *Institute for Diabetes and Cancer (IDC), Helmholtz Diabetes Center, Helmholtz Zentrum München, Neuherberg, Germany*
4. GERMAN CENTER FOR DIABETES RESEARCH (DZD), *Neuherberg, Germany*
5. NOVO NORDISK FOUNDATION CENTER FOR BASIC METABOLIC RESEARCH, *University of Copenhagen, Copenhagen, Denmark*
6. DEPARTMENT OF MOLECULAR MEDICINE AND SURGERY, *Integrative Physiology, Karolinska Institutet, Stockholm, Sweden*
7. 6NSTITUTE FOR GENOMICS AND BIOINFORMATICS, *University of California, Irvine, Irvine, CA, USA*
8. COMPUTATIONAL DISCOVERY RESEARCH, *Institute for Diabetes and Obesity (IDO), Helmholtz Diabetes Center (HDC), Helmholtz Zentrum München, Neuherberg, Germany*
9. DEPARTMENT OF PHYSIOLOGY AND PHARMACOLOGY, *Integrative Physiology, Karolinska Institutet, Stockholm, Sweden*

› **Background**: Exercise provides a myriad of health benefits, with mode, intensity, duration, and frequency all determining magnitude of effect. Tissue sensitivity and response to exercise varies according to time of day and alignment of circadian clocks, but the optimal exercise time to elicit a desired metabolic outcome is not fully defined.
› **Method**: We mapped and integrated the global metabolite response of 8 different mouse tissues after an acute 1hr bout of exercise performed at different times of the day. Applying a systems biology approach, we uncovered how tissues independently and collectively respond to exercise.
› **Results**: Comparative analysis underscored how tissues are metabolically connected and revealed how metabolites are used for communication among tissues to maintain metabolic homeostasis in response to exercise. Specific metabolic outcomes were determined by time of exercise.
› **Conclusion**: This comprehensive atlas of exercise responses provides clarity and context regarding the production and distribution of signaling metabolites, and gives insight into the health promoting benefits of exercise on systemic metabolism.

NR. 254 OP-14-003 GERMAN MOL. EXERCISE PHYS. GROUP

Wessner, B[1], Gumpenberger, M[2], Csapo, R[2]

Skeletal Muscle Extracellular Matrix Remodelling by Age and Training Stimuli

1. CENTRE FOR SPORT SCIENCE AND UNIVERSITY SPORTS, *Research Platform Active Ageing, University of Vienna*
2. RESEARCH UNIT FOR ORTHOPAEDIC SPORTS MEDICINE AND INJURY PREVENTION, *Private University for Health Sciences, Medical Informatics and Technology*

› **Background:** Skeletal muscle exerts its primary role in the maintenance of upright posture and the production of movement, but is also involved in numerous other physiological processes. Frequently, research has focused on muscle cells while sometimes overlooking that muscle fibers reside in a three-dimensional scaffolding, commonly referred to as extracellular matrix (ECM). Therefore, the aim of this set of studies was to investigate the impact of age and training stimuli on molecular pathways involved in ECM remodelling.
› **Methods:** In a pilot study, 5 young (23.8±2.2 yrs) and 5 elderly (66.8±4.1 yrs) men performed one session of unilateral leg press and leg extension exercises. Six hours post-exercise, biopsies were taken from the vastus lateralis muscles of both legs. The differential expression of 84 ECM-related genes was profiled by PCR array. In a subsequent study, 26 healthy men (66.9±3.9 yrs) were stratified to two of four groups, performing unilateral (i) conventional resistance exercise, (ii) conventional resistance exercise followed by self-myofascial release (CEBR), (iii) eccentric-only exercise (ECC) or (iv) plyometric jumps (PLY). The expression of genes associated with ECM collagen synthesis, collagen degradation and peptidase inhibitors were assessed from skeletal muscle biopsies.
› **Results:** Seventeen ECM-associated genes were differently altered (>1.5-fold change) in young and old subjects. Interestingly, collagen degradation was affected as MMP9 expression increased in young (9.7-fold) but decreased (0.2-fold) in old participants. MMP15 was down-regulated only in the old (0.6-fold). The various training modalities in the subsequent study differently affected MMP3, MMP15 and TIMP1, with the greatest responses in MMP3 and TIMP1 seen in CEBR and in MMP15 in ECC.
› **Conclusion:** The altered expression of genes encoding matrix metalloproteinases (MMP3, MMP9, MMP15) highlights the role of remodelling processes in response to an acute bout of resistance exercise, whereby age and training modality seem to be moderating factors. Long-term training studies will test whether the execution of ECM-challenging exercises may help to counter age-associated loss of muscle weakness.

NR. 255 OP-14-004 GERMAN MOL. EXERCISE PHYS. GROUP

Jacko, D[1], Bersiner, K[2], Bloch, W[3], Gehlert, S[2]

Effects of acute Resistance Exercise and Training on the Immediate Stress Defense Response in Skeletal Muscle Fibers indicated by alpha B-Crystallin

1. GERMAN SPORT UNIVERSITY COLOGNE & OSP NRW/RHEINLAND
2. UNIVERSITY OF HILDESHEIM
3. DEUTSCHE SPORTHOCHSCHULE KÖLN, *Abteilung Molekulare und Zelluläre Sportmedizin, Institut für Kreislaufforschung und Sportmedizin*

› **Background**: The conservation and improvement of mechanical stress-resistance and hence functional capability of skeletal muscle is a main challenge in health and disease. Skeletal myofibers have developed diverse systems to cope with cell stress to maintain proteome stability. In the immediate stress defense response, small heat shock proteins, including α B-crystallin (CRYAB), play an important role, while ongoing mechanical stress resistance is provided by cytoskeletal proteins like desmin.
› **Methods**: To determine, how resistance exercise-induced mechanical stress effects myocytes, we investigated CRYAB phosphorylation at serin 59 (pCRYABS59), its translocation as well as desmin expression patterns in consequence of various kinds of acute resistance exercises, differing in load intensity and volume, as well as in the course of a chronic training period with a short phase of detraining.
› **Results**: Acute exercise-induced a strong fiber type specific pCRYABS59 response which was depending on exercise intensity and volume, i.e. type II fibers displayed a pCRYABS59 staining only following high intensive loading, or moderate intensive loading of high volume. Translocation and association of CRYAB to cytoskeletal components was as well fiber type specific and contingent on load intensity. Chronic training induced an increase in desmin content and also modifies the immediate pCRYABS59 response in the sense that it was blunted at the latest after ten exercise sessions. Training termination and subsequent loading led to renewed pCRYABS59 increase, while desmin tended to be downreguated, then.
› **Conclusion**: We conclude, that pCRYABS59 indicates contraction induced mechanical stress exposure of single myofibers in consequence of resistance exercise. Further, it reflects increase and decrease in resistance to mechanical stress, in which a reinforced desmin network could play a contributing role by structurally stabilizing the cells.

NR. 256 OP-14-005 GERMAN MOL. EXERCISE PHYS. GROUP

Schranner, D, Schönfelder, M, Römisch-Margl, W, Scherr, J, Schlegel, J, Zelger, O, Riermeier, A, Kaps, S, Prehn, C, Adamski, J, Stöcker, F, Kreuzpointner, F, Halle, M, astenmüller, G, Wackerhage, H

Physiological extremes of the human blood metabolome: a metabolomics analysis of highly glycolytic, oxidative, anabolic athletes and untrained controls

› **Background**: Endurance athletes, bodybuilders and sprinters have extreme concentrations and activities of oxidative, anabolic, or glycolytic enzymes in their musculature. Whilst the blood lactate concentration at a medium intensity workload is a biomarker for oxidative capacity, we know little about how the extreme metabolic capacities of athletes shape the blood metabolome at rest or after exercise.
› **Methods**: To compare and contrast the metabolomes of metabolically diverse athletes, we used a targeted metabolomics strategy to compare the serum concentrations of 151 metabolites and 43 metabolite ratios or sums in glycolytic, oxidative and anabolic athletes versus untrained controls at rest and after a maximum cycle ergometry test.
› **Results**: The analysis of all 194 metabolite measures revealed that natural bodybuilders and endurance athletes were distinct in their metabolite profiles whereas sprinters and untrained controls were similar. Interestingly, natural bodybuilders had lower levels of branched-chain amino acids than all other subjects suggesting that high rates of protein synthesis lead to a depletion of amino acids in the circulation.
› **Conclusions**: The main conclusion of this study is that exceptional metabolic capacities of differently trained athletes shape the blood metabolome at rest and after exercise.

NR. 257 OP-15-001 FROM MECHANISM TO METHODS

Wackerhage, H, Verbrugge, S A, Kempin, S, Pillon, N, Rozman, J, Kleinert, M

Genes whose Gain or Loss-of-Function alters Glucose Uptake in Skeletal Muscle of Mice

- **Background**: Skeletal muscle glucose uptake is increased by exercise and insulin but the underlying mechanisms, as well as the genetics of muscle glucose uptake variation in the humans, are incompletely understood.
- **Methods**: To increase our knowledge of muscle glucose uptake regulation and genetics, we performed a systematic review to identify genes whose gain or loss-of-function alters skeletal muscle glucose uptake in mice. In a second step, we reanalyzed existing datasets to study especially whether muscle glucose uptake genes are regulated by exercise through changed expression or phosphorylation.
- **Methods und Conclusion**: Our systematic literature analysis identified 176 genes whose gain or loss-of-function in mice alters glucose uptake in skeletal muscle. Remarkably, more than half of these muscle glucose uptake genes or their protein products were regulated by exercise, highlighting that one of the key roles of exercise signalling is to extract glucose from the circulation to fuel the metabolic demand of muscle contractions.

NR. 258 OP-15-002 FROM MECHANISM TO METHODS

Burdette, C

From The Microbiome to Muscle Mass: The Athletic Edge And The Mighty Microvilli

- **Background**: Athletes are looking to achieve ultimate health as it will improve performance. Unfortunately, those that should be the pinnacle of health can often fall flat due to over training, and ill-advised strategies resulting in a health demise. While it is easy to understand that athletes have a higher need for nutrition, ares that are overlooked are adrenal fatigue, secondary to the physical stress over training as well as gut based health that is often undervalued in the athlete.
- **Methods and Results**: There is a strong body of evidence that suggests gut dysbiosis, evidenced by biomarkers such as LPS, directly impact training. The athlete is a fascinating example of accelerated gut permeability and its systemic effects. A known consequence of intensive training is ischemia to the gut. This gut based ischemia is due to training, putting one in a sympathetic state, and decreasing time in the parasympathetic state, or the rest and digest state. The athlete can often have a highly permeable gut despite an emphasis on health that results in decreased performance, poor recovery and a lack of over-all improvement. Gut based protocols for the athlete have been shown to improve markers of leaky gut such as Zonulin and LPS, which results in better performance and a decrease in inflammatory markers such as TNF. By evaluating markers of gut health we have a direct and evidenced-based approach to improving athletics through the heart of nutrition, the gastrointestinal tract.
- **Conclusion**: The microbiome may well be one of the most important areas to target in terms of improving lean muscle mass, recovery and athletic outcomes. This talk will evaluate the research around gut based health and how it enhances athletic performance.
- *I am the co-founder of TheraDura, a physician line supplement company.*

NR. 259 OP-15-003 FROM MECHANISM TO METHODS

Marshall, A[1], Rimmer, J[2], Shah, N[3], Bye, K[2], Kipps, C[3], Woods, D R[4], O'Hara, J[5], Boos, C J[6], Barlow, M[5]

Marching to the Beet: The Effect of Dietary Nitrate Supplementation, on High Altitude Exercise Performance and Adaptation during a Military Trekking Expedition

1. UNIVERSITY COLLEGE, *Institute Sport and Exercise Health*
2. DEFENCE MEDICAL SERVICES, *Lichfield*
3. UNIVERSITY COLLEGE, *Department of Surgical Sciences, Institute of Sports and Exercise Health*
4. DEFENCE MEDICAL SERVICES, *Lichfield; Northumbria and Newcastle NHS Trusts, Wansbeck General and Royal Victoria Infirmary, Newcastle*
5. CARNEIGE SCHOOL OF SPORT, *Leeds Beckett University, Leeds*
6. CARNEIGE SCHOOL OF SPORT, *Leeds Beckett University, Leeds, Department of Cardiology, Poole Hospital NHS Foundation trust, Poole; Department of Postgraduate Medical Education, Bournemouth University, Bournemouth*

- **Purpose:** This is the first study to investigate the effect of dietary nitrate supplementation in the form of beetroot juice (BRJ) for > 7 days on nitric oxide (NO) levels, exercise performance, acclimatisation to high altitude (HA) and HA illness.
- **Methods:** This was a single (subject) two-group randomised prospective study of 22 healthyadultparticipants (12 men, 10 women, mean age 28 ± 12 years) across a HA military expedition. Participants were randomised pre-ascent to receive two 70ml shots per day of either BRJ ~12,5mmol nitrate per day (n=11) or non-nitrate calorie matched control (n=11). Participants ingested supplement shots daily, beginning 3 days prior to departure to day 17 of expedition; the highest sleeping altitude (4800m). Data was collected at interval points, baseline (44m) and HA 2350m (day 9), 3500m (day 12) and 4800m (day 17).
- **Results:** BRJ was successful in enhancing bioavailiability of NO measured by salivary NO (p=0,007). There was a significant decrease in peripheral oxygen saturations (SpO2) and increase in heart rate (HR), diastolic blood pressure (DBP) and rating of perceived exertion (RPE) with increasing altitude (p=<0,001). Harvard Step Test fitness scores significantly declined at 4800m in the control group (56,9±7,52), p=0,003) compared with baseline (67.0±8.76)). In contrast BRJ ameliorated the decline in fitness at 4800m (61.9±12.89) compared with baseline (66.3±13.83, p=0,26). Heart rate recovery following exercise testing at 4800m significantly increased in control (p<0,05) compared with baseline, whereas BRJ showed no differences (p>0,05) BRJ did not affect the burden of HA illness (p=1,00).
- **Conclusions:** BRJ increases NO levels and ameliorates the decline in fitness at altitude but does not affect the occurrence of HA illness.

NR. 260 OP-15-004 FROM MECHANISM TO METHODS

Treff, F[1], Mayer, B[2], Schmidt, P[1], Schiefer, L M[1], Schäfer, L[1], Swenson, K E[3], Swenson, E R[4], Sareban, M[5], Berger, M M[6], Steinacker, J M[7] and Treff, G[8]

Reliability of the Blood Gas Analyzer Radiometer ABL 90 Flex is superior to Siemens Rapid Point at 423 m and 4559m

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2. INSTITUTE OF EPIDEMIOLOGY AND MEDICAL BIOMETRY, *Ulm University, Germany*
3. DIVISION OF PULMONARY AND CRITICAL CARE MEDICINE, *Stanford University, Palo Alto, CA, USA*
4. PULMONARY, CRITICAL CARE AND SLEEP MEDICINE, *VA Puget Sound Health Care System, University of Washington, Seattle, WA, USA*
5. INSTITUTE OF SPORTS MEDICINE, *Prevention and Rehabilitation and Research, Paracelsus Medical University, Salzburg, Austria*
6. DEPARTMENT OF ANESTHESIOLOGY AND INTENSIVE CARE MEDICINE, *University Hospital Essen, Germany*
7. DIVISION OF SPORTS AND REHABILITATION MEDICINE, *University Hospital Ulm, Germany*
8. DIVISION OF SPORTS AND REHABILITATION MEDICINE, *Center for Internal Medicine, Ulm University Medical Center*

- **Background:** Blood gas analyzers like Radiometer ABL 90 (RAD) and Siemens Rapid Point 500 (SIE) are frequently used to evaluate changes in blood variables in altitude studies. Since reliability of blood gas analysis is critical for several scientific purposes, we aimed to evaluate the reliability of RAD and SIE in normoxic (423 m) and hypoxic conditions (4,559 m) during a field-based altitude study.
- **Method:** Two arterial blood samples from 13 subjects were drawn in supine position after 10 min of rest once at 423 m and three times at 4559 m (20, 44, and 68 h after ascent), using the respective manufacturer recommended syringes and instructions. Afterwards, samples were analyzed in triplicate in an alternated order between RAD and SIE to assess the directly measured variables hemoglobin concentration ([Hb], mg/dl), carboxyhemoglobin (COHb, %), partial pressures of oxygen (pO2, mmHg) and carbon dioxide (pCO2, mmHg), Lactate ([Lac], mmol/L), and pH. A mixed model was used to calculate the intraclass correlation coefficient ICC (3,1) for each device and variable including all measurements. Coefficients of variation (CV%) were calculated from triplicate measurements and the mixed model was applied to calculate differences in CV between conditions and between devices.
- **Results:** The differences in ICC between RAD vs. SIE ranged from Δ0.01 (0.58 vs. 0.57) for pH to Δ0.30 for COHb (0.61 vs. 0.31). All ICCs except for [Lac] were slightly higher in RAD (0.44 – 0.82, poor to good) than in SIE (0.31 – 0.64, poor to moderate). This result is in line with the CVs, which were always lower in RAD and significantly different between devices for PO2, PCO2, COHb at 423 m and for PCO2, COHb, [Lac], and pH at 4,559 m.
- **Conclusion:** Reliability of RAD was superior to SIE at 423 m and 4,559 m.

NR. 261 OP-15-005 FROM MECHANISM TO METHODS

Dech, S[1], Bittmann, F[1], Schaefer, L[1]

Reliability of a Pneumatic Measuring Device to quantify the Adaptive Force of the Arm Extensors

1. UNIVERSITY OF POTSDAM, *Regulative Physiology and Prevention*

› **Background**: The Adaptive Force (AF) determines the ability to adapt adequately to external forces during a holding isometric (AFiso) and eccentric muscle action (AFecc). This specific neuromuscular function is required in daily activities and in sports. Isokinetic devices are not able to measure the AF, since an increasing external force without a controlled movement speed is needed. The aim of the study was to examine the test-retest-reliability of the maximal AFs (AFisomax and AFeccmax) measured by a pneumatic system and to compare them with each other and the maximal voluntary isometric contraction (MVIC).
› **Method**: 13 healthy subjects participated on two days (7-days apart). The MVIC, AFisomax and AFeccmax of the elbow extensors were measured 4 times each day. The arithmetic mean (M) and maximal (Max) torques between days were compared (t-tests, α=10%). The random errors (standard errors of measurements, SEMs) and Intraclass correlation coefficients (ICC(3,1)) of M and Max torques between days were estimated. M and Max torques of the AFs were compared with each other and those of the MVIC (t-tests, α=5%). Coefficients of variations were calculated of all torques within one day.
› **Results**: Between days, no significant differences were found (p=0.138–0.853). The highest occurred mean difference between days was 1.84 ± 4.21 Nm (Max of MVIC). The SEMs were 1.34–4.57 Nm and ICCs were 0.965–0.997. The AFisomax was significantly lower than the MVIC (p=0.002–0.039) and the AFeccmax (p<0.001–0.011), whereas the AFeccmax did not differ significantly from the MVIC (p=0.093–0.440). The AFisomax was more variable within trials on both days (mean CVs ≥ 16.35 ± 16.99%) than the MVIC and AFeccmax (mean CVs ≤ 5.40 ± 2.92%).
› **Conclusion**: The results suggest that the pneumatic AF device is suitable to generate reliable data. The SEMs should be taken into consideration for the interpretation of prospective group comparisons. The AFisomax is characterized by a lower force and higher variability. It is hypothesized that this specific adaptive holding function could serve as an indicator of the functionality of the neuromuscular system. In this regard, it could be relevant for the explanation of injury mechanisms and complaints of the musculo-skeletal-system.

NR. 262 OP-16-001 EXERCISE AS MEDICINE: SPORTS THERAPY I

Philippi, K[1], Boedecker, S C[2], Neuberger, E[3], Weinmann-Menke, J[2], Simon, P[4]

Higher Effectiveness of a 12-week web-based Aerobic Continuous Training compared to Anaerobic Interval Training in Patients with Systemic Lupus Erythematosus

1. JGU MAINZ
2. UNIVERSITÄTSMEDIZIN MAINZ
3. UNIVERSITY OF MAINZ, *Department of Sports Medicine*
4. DEPARTMENT OF SPORTS MEDICINE, *University of Mainz*

› **Background:** Systemic lupus erythematosus (SLE) is a rare systemic autoimmune disease with a high risk to develop cardiovascular diseases or complications. Most patients suffer from chronic pain, lower quality of life and reduced aerobic capacity. While endurance exercise has been shown to improve aerobic capacity and fatigue, it is not clarified in detail which endurance exercise type is most effective for people with SLE. Here we investigated the effects of aerobic exercise (AEG) and anaerobic exercise (ANG) in SLE using a web-based training intervention with proven effectiveness and safety in cancer and metabolic diseases.
› **Methods:** In this randomized controlled trial, we included 30 participants with SLE in a stable clinical status. After the initial screening and recruitment, participants were randomized in AEG, ANG, and treatment as usual (TAU) as a control group. After 12 weeks, participants of the TAU group could decide if they also want to participate in one of the exercise groups. If approved, these patients were randomly assigned to either AEG or ANG. The primary outcome, VO2peak [ml/min/kg], was determined during a cardiopulmonary exercise test with a modified walking protocol on a treadmill.
› **Results:** Out of 30 recruited patients, 29 started the study and one withdrew beforehand due to a fracture. Three patients dropped out of the study, which lead to 26 patients that fully completed the study. Seven of eight TAU-participants agreed to participate in one of the exercise groups after TAU. This resulted in 12 AEG-, 13 ANG-, 8 TAU-participations. A repeated measures ANOVA revealed significant time and group interaction for VO2peak changes ($p < 0.001$, $h2p = 0.352$). Post Hoc tests showed significant pre to post mean differences of 2.12 (AEG, $p < 0.01$) and statistical trends of 0.94 (ANG, $p = 0.061$) and -1.09 (TAU, $p = 0.087$).
› **Conclusion:** Our results indicate that aerobic exercise is favorable for SLE patients. This could be due to the fact that ANG-patients could not adequately perform the training with high intensities. Further analyses considering the impact of training load and training adherence on the improvement of aerobic capacity will be conducted.

NR. 263 OP-16-002 EXERCISE AS MEDICINE: SPORTS THERAPY I

Schmitz, B[1], Zinn, S[2], Minnebeck, K[3], Nelis, P[4], Hinder, J[2], Eter, N[4], Brand, S[2], Gellner, R[3], Kabar, F[3], Vorona, E[3], Alten, F[4]

High-intensity Interval Training (HIIT) improves Physical Fitness and Metabolic Risk Profile of Type 1 Diabetes Patients

1. DEPARTMENT OF REHABILITATION SCIENCES, *Faculty of Health, University of Witten/Herdecke, Witten, Germany; 2Klinik Königsfeld der DRV, Center for Medical Rehabilitation, Ennepetal, Germany*
2. INSTITUTE OF SPORTS MEDICINE, *University Hospital Muenster, Muenster, Germany*
3. INTERNAL MEDICINE B, *Department of Diabetology and Endocrinology, University Hospital Muenster, Germany*
4. DEPARTMENT OF OPHTHALMOLOGY, *University of Muenster Medical Center, Muenster, Germany*

› **Background**: HIIT may be an effective training modality for the improvement of health-related fitness and cardiovascular risk factors also for patients with diabetes. However, data on short-term HIIT interventions in type 1 diabetes is largely missing from the literature. In this study, we investigated the effect of a four-week HIIT intervention on physical fitness and the metabolic risk profile of patients with type 1 diabetes.
› **Method**: Twenty-two type 1 diabetes patients (median age 45 [18-65] years) performed four weeks of HIIT (4 to 6 bouts of 1 min all-out cycling, 1 min passive recovery) with two sessions per week. Cycle ergometry was used for the determination of physical fitness parameters including power output at individual anaerobic lactate threshold (IAT), maximal power output and heart rate. FibroScan (Echosens, Paris, France) was applied to determine liver fat. Fasting metabolic parameters included HbA1c, triglycerides, low-density lipoprotein (LDL), high-density lipoprotein (HDL), uric acid and alkaline phosphatase (AP). Daily insulin requirement was documented before and during the intervention using data from continuous subcutaneous insulin infusion pumps or insulin diaries. Patients were grouped by body mass index (BMI <25 or ≥25 kg/m2).
› **Results**: Physical fitness in terms of power output at IAT and maximal power output was improved (by 10.5% and 7.5%, both p<0.0001). HbA1c, HDL, and triglycerides did not change, overall AP was lowered (by 3.5%), and LDL and uric acid were reduced (by 7.5% and 10.5%) in patients with BMI ≥25 kg/m2 (all p<0.05). Liver fat tended to be reduced in the BMI ≥25 kg/m2 group but missed significance. During the intervention, participants used fewer insulin (~5%, p≤0.023). One adverse event was recorded in that the blood glucose level of one participant dropped below 60 mmol·L-1.
› **Conclusions**: Already during short-term interventions, HIIT may exert beneficial effects on physical fitness and the metabolic risk profile in type 1 diabetes. Of note, favorable metabolic changes including lower LDL and uric acid levels were observed predominantly in patients with higher BMI. However, for patients with type 1 diabetes, caution is warranted already during shorter HIIT sessions to prevent hypoglycemia.

NR. 264 OP-16-003 EXERCISE AS MEDICINE: SPORTS THERAPY I

Huhn, A[1], Diel, P[1]

Changes in Short-Term Strength Response after combined Strength Training and a Meal rich in Protein and Carbohydrates in Patients with stable COPD - a Pilot Study

1. GERMAN SPORTS UNIVERSITY COLOGNE

› **Background**: Chronic obstructive pulmonary disease (COPD) is one of the world's most common diseases and reasons for death and is associated with age. Systemic consequences of the disease, especially reduced muscle strength, muscle mass and muscle function, are common and contribute in worsening prognosis and increasing morbidity and mortality. There is strong evidence that physical activity and strength training are effective in prolonging life and lead to better quality of life. Ingestion of a meal rich in protein and carbohydrates during the first 30 minutes after strength training can increase regeneration of strength in young athletes. Until now, it is not clear, if patients with COPD, integrated in regular physical training, respond to these macronutrients after training, too.
› **Methods**: In this pilot study, a prescribed strength training was added by a meal rich in protein and carbohydrates and changes in maximum strength and functional capacity after 24 hours were investigated. Influence of this meal should be proved, and confounding factors determined. Pilot study was conducted with pragmatic crossover design. Subjects trained twice, once added by a meal consisting of a white bin and sour milk cheese.
› **Results**: Study design and study protocol can be used for further studies with only small adaptions. Contrary to assumption, strength loss was not seen in all subjects according to physiological reduction of capacity after training. With a nutritive intervention, strength in knee extensor was significantly, strength in chest press highly significantly higher than in control training. Changes in functional capacity were nonsignificant but positive for nutritional intervention.
› **Discussion**: Use of a meal rich in protein and carbohydrates after a strength training can be recommended in COPD. Clinical relevance needs further research. Mechanism is still unclear and should be proved with further studies.

NR. 265 OP-16-004 EXERCISE AS MEDICINE: SPORTS THERAPY I

Spang, C[1], Golonka, W[2], Raschka, C[3]

Isolated lumbar Extension Resistance Exercise leads to a Reduction of Pain Scores and increases Isometric Extension Strength in Patients with Lumbar Disc Herniation, Lumbar Stenosis and Spondylolisthesis – A retrospective Analysis on 586 Patients

1. ORTHOPAEDIC SPINE CENTER, *Würzburg, Germany*
2. UNIVERSITY OF WÜRZBURG, *Institute of Sports Science, Würzburg. Germany*
3. UNIVERSITY OF WÜRZBURG, *Institute of Sports Science, Würzburg, Germany*

› **Background:** The management of pain conditions in the lower back is often challenging. Recent imaging studies have highlighted the occurence of pronounced atrophy and fatty infiltration in the local paraspinal muscles (Ranger et al., 2017). Isolated lumbar extension resistance exercise (ILEX) has shown promising clinical outcomes in patients with unspecific low back pain (Steele et al., 2015). However, it is unknown if this method can be applied to patients with more specific pain symptoms and verified structural degenerationn such as lumbar disc herniations, stenosis and spondylolisthesis.
› **Methods:** This study is based on a consecutive series of patients that underwent a similar rehabilitation program including one set of ILEX training (18 sessions, 2 times per week). For the study patients were subdivided into groups based on clinical examination and their main diagnoses verified by MRI: A) lumbar disc herniation (n=168; mean age 36,5), B) lumbar stenosis (n=236, mean age 65,5), C) lumbar spondylolisthesis (n=182; mean age 57,1). Range of motion (ROM) of ILEX had been limited and adjusted to the patients' symptoms and flexibility. Before and after the program isometric lumbar extension strength had been tested. Pain/discomfort, mental suffering and satisfaction rates had been measured via Numeric Pain Rating Scale (NRS, 0-10) and overall rehabilitation progress stated in % (0-100, 100%=completely pain free).
› **Results:** Altogether 537/586 (91,6%) of patients reported reduction of clinical symptoms (A: 96,4%; B: 86,9%, C: 93,4%). NRS scores for pain and discomfort decreased in A) from 4,2 (±1,5) to 1,9 (±1,5) (p<0,001), in B) from 5,7 (±2,2) to 3,7 (±2,1) (p<0,001) and for patients in C) from 4,9 (±2,4) to 3,3 (±2,6) (p<0,001). Furthermore, the scores for mental suffering decreased in the same manner (p<0.001). The average increase of isometric strength was 58,8%. Patients from group A) had significantly higher satisfaction rates and better rehabilitation progress than those from B) and C) (p<0,001).
› **Conclusion:** It can be concluded that patients with disc herniation and also those with advanced stages of spine degeneration can successfully be treated with ILEX. Thus, ILEX is a promising treatment method and can potentially avoid surgeries and improve post-operative results.

NR. 266 OP-16-005 EXERCISE AS MEDICINE: SPORTS THERAPY I

Roempler, J[1], Ströhle, A[2], Petzold, M[2]

Physical Activity as a vital Sign in Patients of the Department of Psychiatry and Psychotherapy at the Charité Campus Mitte

1. CHARITÉ DEPARTMENT OF PSYCHIATRY
2. DEPARTMENT OF PSYCHIATRY AND PSYCHOTHERAPY AT THE CHARITÉ CAMPUS MITTE

› **Background:** Physical activity (PA) has a proven beneficial effect on the mental and physical health of people. Studies have shown that especially psychiatric patients participate in significantly less physical activity, compared to the general population. This is why we implemented PA as a vital sign at the department of Psychiatry and Psychotherapy, Campus Charité Mitte, Charité – Universitätsmedizin Berlin in July 2019. The goal of this study was to document, monitor and determine factors of change in physical activity levels during an in-patient treatment, allowing us to find targeted approaches to help specific patient groups.
› **Methods and Results:** Preliminary results have shown us that the average physical activity increases from the date of admission to the date of discharge, however, still many patients do not reach the WHO recommended 150 minutes of moderate to intense physical activity per week. Furthermore, there are big differences in physical activity levels when comparing patients with different primary diagnoses. It is also becoming clear, that only a limited portion of patients are benefiting of exercise-interventions during the in-patient treatment.
› **Conclusion:** Physical activity is becoming ever more important in the field of psychiatry. Utilizing its full potential to improve the health and quality of life of patients is crucial. With this activity we want to further promote the wider and simultaneously targeted use of physical activity in psychiatry.

NR. 267 OP-16-006 EXERCISE AS MEDICINE: SPORTS THERAPY I

Teschler, M[1], Schmitz, B[1], Heimer, M[1] and Mooren, F[1]

Electromyostimulation (EMS) for the Treatment of Sarcopenia in Medical Rehabilitation

1. UNI WITTEN/HERDECKE

› **Background:** Sarcopenia is defined as loss of muscle mass, quality, and function and is associated with reduced quality of life and adverse health outcomes including disability and mortality. In the setting of medical rehabilitation, sarcopenia impairs patients' participation in physical exercise and other activities, decreasing recovery and overall rehabilitation effectiveness. EMS, as a non-invasive option to stimulate and amplify voluntary muscular contraction, may improve muscle strength and function also in deconditioned subjects. This study is first to investigate whether EMS training may be helpful to enhance the recovery process in rehabilitation patients.
› **Methods:** One-hundred-twenty sarcopenic patients (55.4±7.8 years) defined as appendicular lean mass (sum of lean arm and leg mass) adjusted for BMI <0.789 (males) and <0.512 (females) performed 6 EMS training sessions during a 4-week inpatient rehabilitation. Participants were assigned to whole-body EMS (WB-EMS) involving major muscle groups of arms, legs, and trunk or just lower extremity EMS (LE-EMS) involving gluteal muscles and thighs. Both EMS programs used an electrical load ratio of 4 s current/4 s rest in combination with an exercise program (2×8 exercises, 20 min) including variations of squats and lunges. A control group (CG) performed exercise training only. The diagnostic battery included body composition, strength (arm, leg, trunk extension/flexion, handgrip), Six-Minute Walking Test and Chair Rise Test, ergometer testing with ECG and blood pressure, cardiometabolic parameters and SF-36 questionnaire.
› **Results:** Overall participants' BMI, visceral fat mass, and low-density lipoprotein levels were reduced, while arm, leg, trunk (extension/flexion) and handgrip strength, 6-minute-walk and chair-rising-test, ergometer time and heart rate recovery were improved (all p<0.05). Repeated measures two-way ANOVA revealed significant time×group interaction effects, suggesting that additional improvements of Chair Rise Test and leg extension were induced by EMS training (all p≤0.023). Overall strength increased significantly higher in WB-EMS (29%) vs. ~18% in LE and CG (p<0.035). No differences between, and adverse events during WB-EMS and LE-EMS training were observed.
› **Conclusions:** EMS may provide additional health benefits for sarcopenic patients via greater functional and strength improvements during medical rehabilitation. Future studies will investigate the use of EMS also in other patient groups.

NR. 268 OP-17-001 EXERCISE AS MEDICINE: SPORTS THERAPY II

Hiura, M[1], Nariai, T[2], Sakata, M[3], Ishibashi, K[3], Wagatsuma, K[3], Tago, T[3], Toyohara, J[3], Ishii, K[3], Katayama, Y[1]

Characteristics of Cerebral Blood Flow elicited by Exercise Intervention for Patients with Hypertension and Ischemic Cerebrovascular Diseases

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2. TOKYO MEDICAL AND DENTAL UNIVERSITY
3. TOKYO METROPOLITAN INSTITUTE OF GERONTOLOGY

› **Introduction:** Dynamic exercise is beneficial for brain health but its underlying mechanism is yet to be explored. Cerebral blood flow (CBF) can be measured using positron emission tomography (PET) during exercise with specific settings. When considering exercise intervention for patients, it is important to identify characteristic of patients in terms of brain metabolism. To clarify CBF among patients, we investigated CBF of hypertensive patients with ischemic cerebrovascular diseases during cycling exercise using PET.
› **Methods:** Eleven healthy male volunteers (HV) and five male patients with ischemic cerebrovascular diseases but were tolerable for regular exercise habit (IP) participated. They performed 20 min cycling exercise and global (gCBF) and regional CBF (rCBF) were measured using oxygen-15-labeled water and PET at the baseline(Rest), onset (Ex1), continued phase (Ex2) and 10, 20 and 30 min after the cessation of exercise (Post 10, 20 and 30 min). Heart rate and mean blood pressure (MBP) were monitored. With the accumulated image and the measured arterial input function, rCBF was calculated using the autoradiographic method.
› **Results:** MBP was significantly higher in IP than in HV at Ex1 (130 ± 14 vs. 103 ± 10 mmHg, p<0.0001). MBP decreased at Post 20 min compared with Rest in HV (from 90 ± 8 to 85 ± 9 mmHg, p<0.001) but did not decrease in IP. Changes in gCBF from Rest to Ex1 were not significantly different between HV and IP (13.4 ± 14.5 vs. 13.6 ± 8.2 %, p=0.97). Changes in gCBF from Rest to Ex2 had a tendency of inconsistency between HV and IP (3.0 ± 7.9 vs. -5.0 ± 6.9 %, p=0.40). For Ex2, rCBF in hippocampus and cerebellum changing pattern was different (Two way ANOVA, p<0.05 for interaction).
› **Discussion & Conclusion:** Changes in CBF induced by exercise was similar between HV and IP despite apparent difference in MBP. For fluctuation of CBF elicited by exercise, difference between IP and HV would be related with occlusive change in vasculatures. Although risk factors including hypertension and post-stroke conditions are to be considered well, stroke patients with stable condition may be feasible to exercise in terms of brain circulation.

NR. 269 OP-17-002 EXERCISE AS MEDICINE: SPORTS THERAPY II

Meyer, M[1], Brudy, L[1], Hager, A[2], Oberhoffer, R[1], Ewert, P[2], Müller, J[1]

Bridging the Gap for Patients at Distance – 24 Weeks of home-based Exercise for Pediatric Patients with Congenital Heart Disease – Chance or Challenge?

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2. DEPARTMENT OF PEDIATRIC CARDIOLOGY AND CONGENITAL HEART DISEASE, *German Heart Centre Munich, Technical University Munich, Munich, Germany*

› **Introduction**: Children with congenital heart disease (CHD) can suffer from motor deficits causing reduced health-related physical fitness (HRPF). These can persist into adulthood and also limit health-related quality of life (HRQoL). This study aimed at improvement of HRPF and HRQoL in pediatric patients with CHD using a 24-week web-based exercise intervention.
› **Methods**: 70 patients (age: 10-18 years) with moderate or complex CHD severity were included. Patients were randomly allocated 1:1 to an intervention group (IG) with a web-based exercise intervention lasting 24 weeks - three times à 20 min/week or a control group (CG) without any intervention (NCT03488797). HRPF was assessed at t0=baseline, t1=24 weeks, weeks post intervention with five tasks of the FITNESSGRAM® (FOOTLOOSE: DRKS00018853) that build a total motor function score (TMFS) which was compared with a healthy reference cohort.
› **Results**: 70 patients (13.0 ± 2.6 years; 34°% girls) were included to IG (n=12 moderate, n=23 complex CHD) or CG (n=13 moderate, n=22 complex CHD). Nine subjects refused t1 follow-up due to personal reasons. There was no significant difference in TMFS from t0 to t1 (IG: 0.14 ± 0.38 vs. CG: 0.09 ± 0.38, p=0.560) and total HRQoL (IG: -1.73 ± 8.33 vs. CG: 1.31 ± 7.85, p=0.160).
› **Conclusion**: HRPF and HRQoL in pediatric patients with moderate or complex CHD could not be improved sufficiently. However, the 24-week web-based exercise intervention was feasible and safe. Despite regular reminders, using emails or phone calls, appropriate training participation could not be achieved.

NR. 270 OP-17-003 EXERCISE AS MEDICINE: SPORTS THERAPY II

Zacher, J[1], Dillschnitter, K[1], Freitag, N[2], Bloch, W[2], Bjarnason-Wehrens, B[1], Predel, H G[1], Schumann, M[2]

Exercise Interventions in the Treatment of atrial Fibrillation: Study Protocol of the Cologne ExAfib Trial

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2. INSTITUT FÜR KREISLAUFFORSCHUNG UND SPORTMEDIZIN, *Abteilung 2 / Deutsche Sporthochschule Köln*

› **Background**: Atrial fibrillation (AF) is the most common form of cardiac arrhythmia and is associated with comorbidities such as coronary artery disease and heart failure. Common symptoms include dyspnea, palpitations and angina pectoris, all of which can dramatically decrease overall quality of life. Limited data suggest that exercise is safe and beneficial in AF patients, but thorough investigations of different exercise modalities and intensities are lacking. Thus, the primary aim of the Cologne ExAfib Trial is to assess the safety and feasibility of different exercise interventions in patients diagnosed with AF. Secondary outcomes include assessment of effects on physical function, AF burden, quality of life, inflammation, morphological adaptations and cardiac function.
› **Methods**: In the initial pilot phase of this 4-armed randomized controlled trial we aim to enroll 60 patients (age: 60-80 years) with paroxysmal AF. After screening and pre-testing, patients will be randomized to one of the following groups: High-intensity-interval-training (4x4 minutes at 75-85% peak power output (PPO)), moderate-intensity continuous training (25 minutes at 55-65% PPO), strength training (whole body, 6-12 repetitions at 70-90% 1 RM) or a no training control group. Training will be performed twice weekly for 12 weeks. If the feasibility and safety will be confirmed through the initial pilot phase, the recruitment will be continued and powered for a clinical endpoint.
› **Results**: Safety will be determined based on recorded adverse events. Feasibility will be assessed based on the drop-out rates and training documentation. Physical function will be assessed by measures of VO2peak and the 1RM of selected muscle groups. AF burden (IBL-VF) and quality of life (SF-36) will be assessed by selected questionnaires. Inflammatory status will be determined by concentrations of CRP, IL-6 and TNF-α. Muscle cross-sectional area will be assessed by ultrasound, cardiac function by echocardiography including strain analysis and NTproBNP.
› **Conclusion**: With this study we aim to underline the safety and feasibility of different exercise interventions in the growing patient cohort diagnosed with AF. Furthermore, it is expected to build a solid base for further studies into distinct exercise interventions within a precision exercise medicine approach for patients with AF.

NR. 271 OP-17-004 EXERCISE AS MEDICINE: SPORTS THERAPY II

xxxx Streese, L[1], Guerini, C[1], Bühlmayer, L[1], Lona, G[2], Hauser, C[1], Bade, S[1], Deiseroth, A[1], Hanssen, H[2]

Physical Activity and Exercise Affect retinal Microvascular Health: a Systematic Review

1. DEPARTMENT OF SPORT, *Exercise and Health, Medical Faculty, University of Basel, Basel, Switzerland*
2. UNIVERSITÄT BASEL, *Bereich Sport- und Bewegungsmedizin, (Departement für Sport, Bewegung und Gesundheit), Basel*

› **Background and aims**: Physical activity (PA) and fitness are important modulators of vascular ageing and may therefore help expand individual health span. We aimed to systematically review the association of PA and fitness as well as the effects of exercise interventions on the new microvascular biomarkers retinal arteriolar (CRAE) and venular (CRVE) diameters as well as the retinal flicker light-induced dilatation (FID) in children and adults.
› **Methods**: PubMed, Ovid, The Cochrane, EMBASE and Web of Science were searched. 805 studies were found, and 25 full-text articles were analysed. Twenty-one articles were included in this systematic review.
› **Results**: Higher PA levels were associated with narrower CRVE in children and adults. Physical inactivity was associated with wider CRVE in both age groups. Combined aerobic and motor skill training in school settings lead to wider CRAE in children. Aerobic exercise interventions in adults with or without CV risk factors induced wider CRAE and narrower CRVE. Studies on the effect of exercise on FID are scarce. In a twelve-week randomized controlled trial, high-intensity interval training significantly improved FID in older patients with CV risk factors.
› **Conclusions**: Higher PA and fitness levels were associated with improved retinal microvascular health in children and adults. Short-term exercise interventions in healthy children and adults as well as CV risk patients improved retinal microvascular structure and function. Exercise has the potential to counteract microvascular remodelling and development of small vessel disease during lifespan. Retinal vessel analysis can differentiate the beneficial effects of exercise on target microvascular organ damage.

NR. 272 OP-17-005 EXERCISE AS MEDICINE: SPORTS THERAPY II

Größer, V[1], Bauer, P[2], Hamm, C[1], Frech, T[2], Krüger, K[3], Weyh, C[1]

Influence of a low-dose Exercise Intervention on immunosenescence and vascular Ageing in elderly Persons

1. JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
2. JUSTUS- LIEBIG UNIVERSITÄT GIESSEN
3. JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN, *Abteilung für Leistungsphysiologie und Sporttherapie, Institut für Sportwissenschaft, Gießen*

› **Background**: In the elderly a chronic systemic inflammation prevails and contributes to the physiological ageing process of the immune (immunosenescence) and vascular system (vascular ageing). Both inflammation and immune aging are at least partially dependent on lifestyle factors, such as physical activity. Hence, inactivity contributes to a higher inflammatory burden which in turn favors an increased vascular aging and the associated risk of degenerative diseases like atherosclerosis.
› **Objective**: This study aims to identify the mechanisms by which a low- dose exercise intervention can counteract immune aging, inflammation and vascular aging in healthy older subjects. Further, we aim to identify early biomarkers of immunosenescence and vascular ageing.
› **Studydesign**: This single-center pilot study plans to enroll 200 participants. Inclusion criteria are age ≥55 years and freedom of medication. Further, subjects with chronic inflammatory diseases or contraindications for the planed exercise intervention will be excluded. In a first step, screening examinations of circulating markers of inflammation and T cell aging (TNF-α, IL-6, naïve T cells, T-EMRA cells, CD4/CD8-ratio), cardiovascular functional parameters (LVEF, pulse wave velocity, ankle-brachial-index, central and peripheral blood pressure, carotid sonography) and cardiopulmonary fitness (VO2peak) will be assessed to exclude preexisting cardiovascular impairment.
› Then, the included participants will be assigned to an intervention (n=100) and control group (n=100). The exercise intervention group will participate in a guided walking tour of 5300 steps, which is offered daily as a supervised walk or a home activity. At least three sessions per week should be accomplished.
› The primary endpoint of the study is the change of lymphocyte subgroups and CD4/CD8-ratio after 2 years of training. Secondary endpoints include changes in cardiovascular function, the evolution of traditional cardiovascular risk factors, quality of life and circulating markers of inflammation. Possible differences in terms of long-term adherence to the prescribed exercise regimen will be assessed by regular reassessment of VO2peak after 24 and 48 months in both groups. Enrolment will start September 2020; last enrolment is expected for September 2021.

NR. 273 OP-17-006 EXERCISE AS MEDICINE: SPORTS THERAPY II

Neunhaeuserer, D[1], Patti, A[2], Niederseer, D[3], Kaiser, B[4], Cadamuro, J[5], Lamprecht, B[6], Ermolao, A[7], Studnicka, M[4], Niebauer, J[8]

Systemic Inflammation, vascular Function and endothelial Progenitor Cells after High-Intensity Exercise Training with and without supplemental Oxygen in COPD

1. UNIVERSITY OF PADOVA, *Department of Medicine, Comprehensive Care Obesity Centre, Padova, Italy*
2. UNIVERSITY OF PADOVA, *Sport and Exercise Medicine Division, Department of Medicine*
3. UNIVERSITY HOSPITAL ZURICH, *Division of Cardiology, University Heart Centre*
4. PARACELSUS MEDICAL UNIVERSITY OF SALZBURG, *University Clinic of Pneumology*
5. PARACELSUS MEDICAL UNIVERSITY OF SALZBURG, *Department of Laboratory Medicine*
6. JOHANNES-KEPLER-UNIVERSITY, *Department of Pulmonary Medicine, Kepler-University-Hospital*
7. UNIVERSITY OF PADOVA, *Department of Medicine, Sport and Exercise Medicine Division, Padova, Italy*
8. PARACELSUS MEDICAL UNIVERSITY OF SALZBURG, *University Institute of Sports Medicine, Prevention and Rehabilitation*

› **Background:** Exercise training is a cornerstone of the treatment of COPD in all disease stages. Data about the training effects with supplemental oxygen in non-hypoxemic patients remains inconclusive. In this study we set out to investigate the training effects on inflammatory markers, vascular function and endothelial progenitor cells (EPCs) in this population with increased cardiovascular risk.
› **Methods:** In this prospective, randomized, double-blind, cross-over study, 29 patients with non-hypoxemic COPD performed combined endurance and strength training three times a week while breathing medical air or supplemental oxygen for the first six-week period, to be then reallocated to the opposite gas for the following six weeks. Exercise capacity, inflammatory biomarkers, endothelial function (Peripheral Arterial Tone (PAT) analysis) and EPCs were assessed. Data were also analyzed for a subgroup with endothelial dysfunction at training begin (Reactive Hyperaemia Index (RHI) <1,67). The study effects were considered statistically significant when p≤0,05.
› **Results and Conclusion:** Following 12 weeks of exercise training, patients demonstrated a significant improvement of peak work rate and an associated decrease of blood fibrinogen and leptin. Eosinophils were found significantly reduced after exercise training in patients with endothelial dysfunction. In this subgroup, PAT analysis revealed a significant improvement of RHI. Generally, late EPCs were found significantly reduced after the exercise training intervention. Supplemental oxygen during training positively influenced the effect on exercise capacity without impact on inflammation and endothelial function. This is the first RCT in patients with COPD to show beneficial effects of exercise training not only on exercise capacity, but also on systemic/eosinophilic inflammation and endothelial dysfunction.

NR. 274 OP-18-001 PHYSICAL ACTIVITY AND HEALTH PROMOTION

Zimmer, S[1], Auerswald, T[1], Stäuber, A[1], Klass, M[1], Waury, D[2], Jahn, G[1], Voelcker-Rehage, C[3], Schulz, H[2]

The biopsychosocial Profile of elderly Nursing Home Residents in Thuringia and Saxony. A cross-sectional Analysis.

1. TECHNISCHE UNIVERSITÄT CHEMNITZ
2. TECHNISCHE UNIVERSITÄT CHEMNITZ, *Professur Sportmedizin/-biologie*
3. UNIVERSITÄT MÜNSTER

› **Background:** Physical activity in nursing home residents has been shown to be relevant for preserving and improving the ability to perform ADL and physical as well as cognitive functional capacity. Main goals of preventive measures in nursing home settings are the empowerment of health-promoting potentials of residents themselves as well as those of their surrounding structures. Knowledge about nursing home residents' physical and cognitive function as well as health-related quality of life (HRQoL) is necessary to derive consensus guidelines and adequate exercise interventions studies for this highly vulnerable population.
› **Methods:** Between 12/2019 and 02/2020 a total of n=240 nursing home residents of eight facilities in Saxony and Thuringia (m=72, f=196, age: 87 (Q25: 82/Q75: 92years; BMI: 27 (Q25: 23/Q75: 34 kg/m 2 ; 56% walking) have been examined, using an array of assessments with focus on reaction time (RDT=ruler drop test), upper-body strength (HGS=handgrip strength) and lower-body functional capacity (SPPB=Short Physical Performance Battery). Cognitive function was assessed by Montreal Cognitive Assessment (MoCA). The short form of the Center for Epidemiologic Studies Depression Scale (CES-D11) was used for evaluation of depression. The qu antification of HRQoL was conducted using the EQ-5D-3L VAS. All data are presented as Median (IQR).
› **Results:** RDT was assessable in n=68 (m=18; f= 50) residents and revealed a reaction time of Q50=0,23 sec (Q25=0,20/Q75=0,26; m=0,24; 0,17/0,26; f=0,23; 0,20/0,27 sec). Upper body strength was obtained in n=73 (m=23; f=50) residents (HGS: 16; 11/21; m=22; 17/27,5; f=14; 10/18; in kg) . SPPB could be administered to n=79 (m=22; f=57) residents (Q50=3; 0/4,5; m=3; 0/6 ; f=3; 0/4; in points) . MoCA values (n=102; m=27; f=75) presented with Q50=13 (8/19; m: 14; 8,5/19 ; f: 13; 8/18,5) . CES-D11 scores were between 0 and 19 points (Q50=6; 4/9; m=8, 4/10; f=6; 4/9). Participants (n=104; m=27; f=77) reported a subjective health of Q50=57,5; 50/77 (EQ-5D-3L VAS; m=50; 50/70; f=60; 50/80).
› **Conclusion:** Our data may help to identify health-related limits and potentials of nursing home residents in order to develop adequate behavioral and relational preventive intervention programmes for this frail population.

NR. 275 OP-18-002 PHYSICAL ACTIVITY AND HEALTH PROMOTION

Hoekstra, F[2], Seves, B[3], Hoekstra, T[1], Hettinga, F[5], Krops, L[6], Dekker, R[6], van der Woude, L[7]

Diversity in Physical Activity Behavior during and after Rehabilitation: the ReSpAct study

1. UNIVERSITY MEDICAL CENTER GRONINGEN
2. UNIVERSITY OF GRONINGEN, *University Medical Center Groningen, Department of Human Movement Sciences, Groningen, The Netherlands; University of British Columbia Okanagan, School of Health and Exercise Sciences, Kelowna, Canada*
3. UNIVERSITY OF GRONINGEN, *University Medical Center Groningen, Department of Human Movement Sciences, Groningen, The Netherlands*
4. VRIJE UNIVERSITEIT AMSTERDAM, *Department of Health Sciences, Amsterdam, The Netherlands*
5. NORTHUMBRIA UNIVERSITY, *Department of Sport, Exercise and Rehabilitation, Newcastle, UK*
6. UNIVERSITY OF GRONINGEN, *University Medical Center Groningen, Department of Rehabilitation Medicine, Groningen, The Netherlands*
7. UNIVERSITY OF GRONINGEN, *University Medical Center Groningen*

› **Background**: Physical activity (PA) behaviors among a diverse sample of people with a physical disability/chronic disease during and up to 1 year after rehabilitation was measured in the context of personal and disease characteristics. We aim to provide an overview of PA over time and to examine associations among non-modifiable determinants and change of PA behavior over time.
› **Methods**: A diverse sample of persons with physical disabilities and chronic diseases who participated in the Rehabilitation, Sports and Active lifestyle (ReSpAct) study (N=1719) were followed up to 1 year post rehabilitation: at baseline (T0: 3-6 weeks before discharge), 14 (T1), 33 (T2) and 52 (T3) weeks after discharge from rehabilitation. PA was assessed with an adapted version of the Short Questionnaire to Assess Health-enhancing physical activity (SQUASH) questionnaire. Descriptive analyses, repeated measures ANOVA and regression analyses were, respectively, used to describe PA behavior, assess change in PA and examine associations of age, sex, disability, education level with PA change between T0 and T3.
› **Results**: Eventually 711 participants completed all measurement moments and were analyzed. PA at T0 to T3 was: 630 (IQR 990), 840 (IQR 1333), 870 (IQR 1287) and 750 (IQR 1298) minutes per week. Moderate to vigorous (MVPA) was 225 (IQR 450), 300 (IQR 540), 280 (IQR 660) and 240 (IQR 555) at T0 to T3. Both PA and MVPA changed significantly over time (p<0,001). At T0, 60% of the patients adhered to the 150 min MVPA/week guideline, which increased slightly to 62% at T3. Top 3 of leisure time PA's were: fitness (T0: 29%, T3: 31%), swimming (T0: 20%, T3: 18%) and walking (T0: 7%, T3: 6%). Of personal characteristics only age was significantly associated with PA change score (β=-6,8, p<0,001), with a higher age resulting in a lower change score. Also, having a neurological disorder (β=-303,6, p=0,02) or chronic pain (β=-278,4, p=0,04) showed a significant lower PA change score (compared with musculoskeletal disorders).
› **Conclusion**: PA increases over time from discharge up to 1 year after rehabilitation.

NR. 276 OP-18-003 PHYSICAL ACTIVITY AND HEALTH PROMOTION

Bento, A[1], Carrasco, L[2], Raimundo, A[1]

School-based High-Intensity Interval Training Programs for promoting Physical Exercise: a Systematic Review

1. UNIVERSIDADE DE ÉVORA, ESCOLA DE CIÊNCIAS E TECNOLOGIA – DEPARTAMENTO DE DESPORTO E SAÚDE; COMPREHENSIVE HEALTH RESEARCH CENTER, (CHRC)
2. BIOFANEX, UNIVERSIDADE DE SEVILHA, SPAIN

› **Background:** High-Intensity Interval Training (HIIT) is a powerful stimulus in improving body composition and cardiometabolic risk in adults, and preliminary data in adolescents are also promising. HIIT is presented as a time-efficient alternative in comparison to aerobic training, that leverages the impact on the number of practitioners of Physical Exercise that results in health outcomes improvements, mainly from adolescents.
› **Method:** The objective is evaluate the utility of a HIIT program integrated in High-School Physical Education classes, on Physical Condition, Physical Activity (PA) and Motivation for Exercise. Data sources through electronic databases PubMed, MEDLINE, SPORTDiscus, CINAHL, MEDICLATINA, COCHRANE and Web of Science, was carried out during March 2019, considering only studies since 2008. Study eligibility criteria: (i) applied to adolescents aged 10-19 years, (ii) HIIT program is applied in a school environment, (iii) outcomes report on physical condition, PA and motivation for exercise (iv) the intervention is at least 4 weeks, (v) randomized controlled trials (RCT).
› **Results:** Of the 5872 studies found a total of 14 studies were included in the review. All works present significant improvements in, at least, 2 of the dimensions evaluated: physical condition and PA. There does not seem to be any great advantage in protocols that last in total more than 10 minutes per session. Improvements in body composition registered, at most, a moderate Effect Size. HIIT is presented as a powerful stimulus in improving physical fitness, mainly on CRF in most protocols, and in power and speed when modality is plyometries. Improvements in PA registered a moderate and large Effect Size.
› **Conclusion:** This review suggests that the introduction of HIIT in the school context has great potential in improving physical fitness and PA, and a moderate effect on improving body composition in adolescents. HIIT efficiency (on average about 10 minutes), reflect the wide applicability that these protocols can have in PE classes, and great adaptation to the facilities (including classrooms).

NR. 277 OP-18-004 PHYSICAL ACTIVITY AND HEALTH PROMOTION

Grinvalds, N[1]

What works for whom, under what Circumstances and why for the Co-Location of Health and Leisure to increase Physical Activity (PA)? A realist Review and Evaluation.

1. SHEFFIELD HALLAM UNIVERSITY

› **Background**: There is widespread acknowledgement of benefits of physical activity (PA) for disease prevention, yet few strategies have lasting effectiveness increasing PA long-term. An alternative to exercise referral schemes (which have low adherence and are neither cost effective or efficacious) are hubs, whereby different services are joined together structurally to remove perceived barriers (including time, distance and cost) and foster multidisciplinary collaboration, exercise and healthcare professionals. In Sheffield, as part of the 2012 Olympic Legacy and in a mission to create a culture of PA, the National Centre for Sport and Exercise Medicine (NCSEM) co-located clinics in leisure centres to embed PA within healthcare, eliminate barriers, and bring care out of hospital and into the community. As this is a new concept, this research aims to provide evidence and theory to explain how co-location of healthcare and leisure is working (or not) to promote PA, for whom, under what circumstances and why.
› **Methods**: A realist review and evaluation were conducted to develop theory and consisted of four processes: (1) document review from databases (2) search for existing theory (3) interviews with NCSEM stakeholders. Data from these processes was combined to form programme theories which were (4) tested in a realist evaluation with patients and healthcare professionals at two co-located leisure centres.
› **Results**: Initial theories integrating 19 elements were developed through the review and stakeholder interviews. Theories were refined with the research team, synthesis with substantive theory, and patient and healthcare professional (HCP) interviews. This refinement process resulted in 9 theories of how co-location of health clinics and leisure centres works to promote PA. Theories include: improvement of staff/patient experience, collaboration/coordination between HCPs and fitness professionals, increasing convenience, modelling/normalisation of PA behaviour, increasing awareness of PA facilities, raising importance of PA, knowledge transfer and reduced health. Inconsistency of the clinical schedule might mean that colocation does not work.
› **Conclusions**: These theories provide a framework for policymakers, healthcare and fitness professionals and stakeholders in health, PA and medicine who aim to develop co-located models, wellness hubs and PA integration within health care as an innovative approach to increase PA and prevent disease.

NR. 278 OP-18-005 PHYSICAL ACTIVITY AND HEALTH PROMOTION

Viegas, R, Albuquerque Godinho, C[1], Romano, S[2], Teixeira, P[3]

Physical Activity Promotion in Portuguese Pharmacies: Pharmacists' Knowledge, Attitudes and Behaviours

1. UNIVERSIDA DE CATÓLICA PORTUGUESA, *Católica Research Centre for Psychological- Family and Social Wellbeing, Portugal*
2. CENTRO DE ESTUDOS E AVALIAÇÃO EM SAÚDE (CEFAR), *Associação Nacional das Farmácias (ANF)*
3. UNIVERSIDADE DE LISBOA, *Faculdade de Motricidade Humana*

› **Background:** Despite abundant evidence on the benefits of physical activity to fostering health, wellbeing and treatment role in many chronic diseases, high levels of physical inactivity are found across different European countries. Healthcare professionals, such as pharmacists, can play a key role in the promotion and maintenance of behaviours contributing to higher levels of physical activity. The present study aimed to characterize physical activity promotion actions of pharmacists taking place in the Portuguese community pharmacies, as well as perceived barriers and facilitators.
› **Method:** A questionnaire was developed based on the COM-B model (Michie et. al., 2011), identifying factors related to Capacity, Opportunity and Motivation in determining pharmacists' Behaviours regarding physical activity promotion. The questionnaire was distributed among 95% of the Portuguese pharmacies by the National Pharmacies Association (ANF).
› **Results:** In total, 396 complete responses were obtained, representing about 5% of Portuguese community pharmacists (n≈8700). Verbal counselling was the physical activity promotion action most referred by pharmacists (92.3%) and walking the main promoted activity (99.4%). Although 95% of the pharmacists agreed that it was important to promote more physical activity, more active, with training in the area and younger pharmacists were more likely to promote physical activity in their daily routines. A lack of referral to the opportunities in the community was also evident. The main identified barriers were related to opportunities for promotion, such as lack of time, lack of coordination with other healthcare professionals or lack of interest by pharmacy users. Regarding motivation, two important barriers referred were being afraid of the health risks and lack of incentives. Pharmacists also showed room for improvement, on factors related to capacity, especially in relation to technical knowledge in the area and knowledge regarding opportunities for referral in the community.
› **Conclusion:** Pharmacists seem to be motivated to engage in different physical activity promotion actions, acknowledging their importance. However, there is a clear need to increase their training and opportunities stimulate physical activity promotion actions.

NR. 279 OP-18-006 PHYSICAL ACTIVITY AND HEALTH PROMOTION

Ulrich, G[1], Breitbach, A P[2]

Interprofessional Collaboration among Sports Science and Sports Medicine Professionals – an international cross-sectional Survey

1. CAREUM FOUNDATION, *Department of Education Management, Zurich, Switzerland*
2. DEPARTMENT OF PHYSICAL THERAPY AND ATHLETIC TRAINING, *Saint Louis University, Saint Louis, USA*

› **Background**: According to the WHO, interprofessional collaboration (IPC) occurs when "multiple health workers from different professional backgrounds work together with patients, families, carers (caregivers), and communities to deliver the highest quality of care". As in other areas of healthcare, the quality of patient care in the field of sport science and sports medicine (SSSM) could benefit from IPC between the professions involved. As a prerequisite, healthcare providers in the SSSM field should be equipped with positive attitudes and perceptions toward IPC and interprofessional education (IPE), however detailed investigations are lacking. Therefore, the aim of this study was to survey and compare interprofessional attitudes and socio-demographics in SSSM professionals from an international perspective.
› **Method**: 320 complete datasets of professionals in SSSM from the regions USA (n=83), Canada (n=179) and Europe (n=58) were evaluated. In this survey, socio-demographic data as well as attitudes toward IPC and IPE using the 4 subscales (communication & teamwork, interprofessional learning, interprofessional interaction, interprofessional relationship) of the University of West of England Interprofessional Questionnaire (UWE-IP) were collected and evaluated via descriptive and inferential statistics.
› **Results**: According to the socio-demographic data, there was a diversity of participants representing different regional healthcare, sports and educational framing conditions. On average, clearly positive attitudes towards interprofessional communication & teamwork, interprofessional learning and interprofessional relationship were documented in USA, Canada and Europe, and only in interprofessional interactions negative perceptions were found. Significant effects of participants' demographic variables region, age and gender on some of the subscales were detected.
› **Conclusion**: Our data confirm a high level of support for IPC and IPE in SSSM professionals, but individual experiences and reality out in practice seem to reflect a contrasting picture. Thus, structures, funding and strategies towards improvement of interprofessional interaction in SSSM should be pushed forward in interprofessional learning settings to improve interprofessional interactions.

NR. 280 OP-19-001 ADAPTATIONS TO EXERCISE

Schmitz, B[1], Niehues, H[2], Lenders, M[3], Thorwesten, L[2], Klose, A[4], Krüger, M[4], Brand, E[3], Brand, S[2]

High-Intensity Interval Training (HIIT) improves endothelial Glycocalyx and affects associated Micro-RNA Levels.

1. DEPARTMENT OF REHABILITATION SCIENCES, *Faculty of Health, University of Witten/Herdecke, Witten, Germany; 2Klinik Königsfeld der DRV, Center for Medical Rehabilitation, Ennepetal, Germany*
2. INSTITUTE OF SPORTS MEDICINE, *University Hospital Muenster, Muenster, Germany*
3. INTERNAL MEDICINE D, *Department of Nephrology, Hypertension and Rheumatology, University Hospital Muenster, Muenster, Germany*
4. DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS HISTORY, *University of Muenster, Muenster*

› **Background**: Vascular endothelial cells are covered by a functional structure of negatively-charged proteoglycans, glycoproteins, and glycosaminoglycans designated as endothelial glycocalyx. Evidence for shear-mediated glycocalyx remodeling exists, which selectively affects shear-induced NO production. A thick glycocalyx may promote vasculoprotective functions, whereas endothelial glycocalyx barrier impairment may lead to increased permeability. This study is first to investigate if high-intensity interval training (HIIT) affects functional and structural microvascular parameters including the endothelial glycocalyx. In addition, circulating levels of glycocalyx-associated microRNAs (miRNAs) were assessed.
› **Methods**: Fifty healthy participants (23.1±3.0 years) performed four weeks of 4x30 s all-out running HIIT with two training sessions/week. Real-time intravital microscopy (sidestream dark-field imaging, CapiScope HVCS, KK Technology, Honiton, UK) was used to detect changes of the sublingual microvasculature (microvessels between 5 and 25 µm in diameter) including microvascular density, red blood cell filling and the endothelial glycocalyx. Exercise parameters were determined by field testing and speed of high-intensity runs was recorded. A structured literature search identified miRNAs potentially associated with regulation of glycocalyx components and thickness. Exercise blood lactate (LA) and miRNA levels were determined from capillary blood.
› **Results**: Participants' maximal running speed was increased at follow-up (by 3%, p<0.0001), while increase in heart rate at submaximal intensities was lower during follow-up exercise testing (p<0.001). Maximal exercise capacity and glycocalyx thickness were significantly correlated at baseline (p=0.045, r=0.303) and increased exercise performance at follow-up also correlated with increased glycocalyx thickness (p=0.031, r=0.416). Increased sprinting speed at follow-up was associated with an increased number of perfused vessels (p=0.0129, r=0.449). miR-143, -96-5p and -24 were upregulated by HIIT and associated with LA after sprints (p<0.05). Increased exercise miR-143 levels at baseline predicted increased glycocalyx thickness at follow-up (AUC miR-143=0.92, p=0.0008).
› **Conclusions**: We conclude that HIIT induces beneficial microvascular changes including an increased number of perfused vessels and thicker endothelial glycocalyx already after short-term interventions.

NR. 281 OP-19-002 ADAPTATIONS TO EXERCISE

Wittke, T[1], Shushakov, V[2], Wendt, M[2], Wendt, U[2], Maassen, N[3]

High-Intensity-High-Volume Training (HIHVT) vs Continuous-Training (CT): An Examination of the Effects after 12 weeks of Intervention

1. KRUKENBERG- CANCER CENTER HALLE, *University Medicine Halle (Saale) & Institute of Sports Medicine/Hannover Medical School*
2. INSTITUTE OF SPORTS MEDICINE/HANNOVER MEDICAL SCHOOL
3. INSTITUTE OF SPORTS MEDICINE/HANNOVER MEDICAL SCHOOL & INSTITUTE OF SPORTS SCIENCE/ GOTTFRIED WILHELM LEIBNIZ UNIVERSITY HANNOVER

› **Background**: Positive effects of training-sessions with High Intensity workloads have been repeatedly highlighted also in our laboratory in recent years (Wittke et al. 2019). Frische & Maassen (2005) already showed the advantages of High-Intensity-High-Volume Training (HIHVT) compared to Continuous-Training (CT) in the period of 3 weeks. But how effective is such a training over a longer period of time?
› **Methods**: N=19 subjects finished our study after 12 week training intervention. All tests and trainings were performed on a cycle ergometer (Lode Excalibur Sport). Pre-tests: Incremental Test (IT) to determine Aerobic Capacity (AEC=Pmax), Endurance Capacity Test (ECT) with 80%Pmax to determine Endurance Capacity (EC=Time to exhaustion). During 2nd-4th, 6th-8th, 10th-12th week training 3 sessions/week were performed. Both groups trained with the same mean mechanical intensity of 50%Pmax beginning with a 10 min warm-up and ended with a cool-down of 10 min both at 50%Pmax. During main-phase, HIHVT-group worked with 55 intervals. One interval contained a 30 s exercise bout (100%Pmax-10 W) and a 30 s active pause (10 W). During main-phase, CT-group continued to work at 50%Pmax for 55 min. In total both trainings lasted 75 min. During 5th and 9th week ITs and during 13th week the post-tests were performed. Training intensity was adjusted according to the results of the ITs.
› **Results**: In pre-tests, there was no significant difference between mean rel.Pmax (HIHVT=4.47±0.9 W·kg-1; CT=4.46±0.7 W·kg-1) and EC (HIHVT=830±217 s; CT=752±147 s) between the groups. After 3 weeks of intervention, rel.Pmax (HIHVT=4.74±0.8 W·kg-1; CT=4.49 W·kg-1, p<0.05) and EC (HIHVT=1224±361.84 W·kg-1; CT=993±187 W·kg-1, n.s.) increased. After 6 weeks of training the result in the IT were similar (HIHVT=4.78±0.65 W·kg-1; CT=4.76 W·kg-1). The same held true in EC (HIHVT=936±220 s; CT=1087±236 s, n.s.). In the post-tests Pmax remained almost constant (HIHVT=4.82±0.77 W·kg-1; CT=4.83±0.79 W·kg-1, n.s.) with no difference between the groups. Mechanical energy produced during the ECT was similar as well: +15% compared to baseline with no significant difference between both groups.
› **Conclusion**: HIHVT with 55 intervals is superior to CT only during the first 3 weeks. On the long-term scale both types of training show similar effects on EC and AEC.

NR. 282 OP-19-003 ADAPTATIONS TO EXERCISE

Bittmann, F N[1]

Significant Differences of mechanical Muscle Oscillations during a specific isometric bilateral Motor task between Parkinson Patients without Tremor and Controls

1. UNIVERSITY OF POTSDAM, *Regulative Physiology and Prevention*

› **Introduction**: The diagnosis of Parkinson´s Disease (PD) is mainly based on clinical examinations. An objective diagnostic tool does currently not exist. The investigation of neuromuscular parameters seems to be obvious because of the affection of the neuromuscular system. Changed patterns of neuromuscular oscillations related to brain circuits or changes in variability of, e.g., gait parameters are reported in several studies, usually in PD-patients with tremor. Studies with patients in pre-motor stages, thus, without tremor, hardly exist. The objective of the present study was to examine whether or not the mechanical muscle oscillations show different oscillatory behaviour between PD-patients without tremor and healthy controls.
› **Method**: The mechanomyography (MMG), force and acceleration (ACC) of 20 PD-patients without tremor (in medication off state) and 20 controls (Con) were measured during a specific bilateral motor task. The MMGs of the biceps brachii, the brachioradialis and of the pectoralis major muscles were recorded using piezoelectric-sensors. Five trials at 60% of the maximal voluntary isometric contraction were performed. For analyses, the frequency, a specific frequency-power-ratio in low frequency ranges as well as the variation and the slope of amplitude maxima were compared between PD and Con (t-test).
› **Results**: The frequency-power-ratio and the amplitude variation of ACC and MMGs differ significantly between PD and Con (power ratio: p=.000–.007; r=.44–.56; amplitude variation: p=.000–.049, r=.26–.66). The 95%-CIs are clearly disjoint. The ACC shows, furthermore, a significant difference concerning the mean frequency (p=.006, r=.45). This is not evident for the MMGs. No significant differences regarding the slope of amplitude maxima were present between the groups.
› **Discussion**: The frequency-power-ratio as well as the amplitude variation as parameters of the mechanical motor output show clear differences between PD patients without tremor and controls during this novel bilateral assessment. If those results will be supported by further studies, an innovative biomarker for PD-patients might be developed. For that, it has to be investigated, if the results are reproducible and specific for PD. It is supposed that those mechanical muscle oscillations reflect neurodegenerative changes, which probably are especially visible during the bilateral motor task.

NR. 283 OP-19-004 ADAPTATIONS TO EXERCISE

Dech, S[1], Bittmann, F[1], Schaefer, L[1]

Behavior of Muscle Oxygenation and Blood Filling in venous Microvessels during a fatiguing isometric Action

1. UNIVERSITY OF POTSDAM, *Regulative Physiology and Prevention*

› **Background:** The capillary-venous oxygen saturation of hemoglobin (SvO2) and the relative hemoglobin amount (rHb) as an indicator of blood filling could be affected by the intramuscular pressure during isometric muscle actions. However, a complete understanding of the behavior of these parameters during that muscular activity is missing.
› **Method:** Ten volunteers (m:7; f:3; mean age ±SD = 28.6 ±11.68 years) were measured during a fatiguing isometric muscle action of the biceps brachii. They had to hold a weight of 60% of their maximal voluntary isometric contraction as long as possible in a 90° elbow flexion. If the elbow angle exceeded 90° for more than two seconds, the weight was taken off, resulting in the subsequent recovery phase. A spectrophotometer (O2C, LEA Medizintechnik GmbH, Gießen, Germany) was used to record SvO2 and rHb via a probe which was stuck on the muscle belly.
› **Results:** Two patterns (type I and type II) could be differentiated. SvO2 generally decreased and leveled off into a steady state, but the deoxygenation was greater in type II (−33.86±17.35 pp, p = .008) than in type I (−10.37 ±2.59 pp). Furthermore, the curve shape of rHb was different. In type I, it was nearly parallel to SvO2, resulting in a positive rank correlation (ρ =0.735, p<.001). In contrast, a partial opposing progression (ρ = −0.522, p<.001) was seen in type II, since rHb increased averagely 13% above the baseline value and leveled off into a steady state after an initial decrease until a reversal point. During recovery, both parameters approached to or increased above the baseline value in both types.
› **Conclusion:** Two behavioral patterns of the capillary-venous muscle oxygenation and blood filling occurred during a fatiguing isometric action. Hypothetically, the oxygenation level serves as a trigger of the regulation of blood filling. The emerged steady states showed that the oxygen delivery and consumption could be balanced during isometric actions, despite a high intramuscular pressure.

NR. 284 OP-19-005 ADAPTATIONS TO EXERCISE

Nitzsche, N[1], Schulz, H[1]

Effect of six Weeks Resistance Exercise on maximal Glycolysis Rate

1. TU CHEMNITZ

› **Background:** Resistance exercise is a heavy strain on the anaerobic energy metabolism. While in endurance training, a reduction of anaerobic performance was found to have no data on resistance exercise. The aim of this study was to investigate the effect of six-weeks of resistance exercise on maximal glycolysis rate (VLamax).
› **Methods:** Twenty two trained male subjects were assigned in an exercise group (EG: n=11) and control group (CG=11; no exercise). The EG trained 3 days per week over 6 weeks (50% of 1RM with 5 sets and 3 exercises by reps up to muscular fatigue). The VLamax and Power (Pmax) was determined using a single leg isokinetic force test (180°s-1, 10 reps) before and after intervention.
› **Results:** The two way ANOVA showed a significant group effect (p= 0.018; eta2= 0.25) but no significant time effect (p = 0.063; eta2= 0.162) with significant interaction effect (time x group) for VLamax (p= 0.015; eta2= 0.26). The VLamax increased in EG (0.27±0.05 to 0.30±0.06 mmol l-1 s-1; p= 0.007) but no significant changes in CG (0.23±0.04 to 0.23±0.05 mmol l-1 s-1; p= 0.639) was detected. In relative Pmax a significant time effect (p= 0.001; eta2= 0.421) and group effect (p< 0.0001; eta2= 0.505) was detected. The Interaction time x group was significant (p= 0.039; eta2= 0.196). The EG increased significantly from 5.25±0.68 N kg-1 to 5.53±0.74 N kg-1 (p= 0.01) and CG showed also significant changes (3.87±0.81 N kg-1 to 3.91±0.83 N kg-1; p= 0.03).
› **Conclusion:** Six weeks of exhaustive resistance exercise increases significantly maximal glycolysis rate.

NR. 285 OP-19-006 ADAPTATIONS TO EXERCISE

Kibele, A[1], Eckardt, N[2]

Beneficial Effects of Instability Resistance Training in older Adults

1. INSTITUTE FOR SPORTS AND SPORT SCIENCE, *University of Kassel, Kassel, Germany*
2. INSTITUTE FOR SPORT SCIENCE, *Carl von Ossietzky University of Oldenburg, Oldenburg, Germany*

› **Using instability resistance training (IRT)** athletes aim to prepare their neuromuscular system for sudden and unforeseen changes in equilibrium impeded by instability, for example, during duels in team sports, on slippery surfaces on rainy days during outdoor activities, or winds and waves during sailing events. Exerting forces during phases of metastable equilibrium requires an interplay in the force production of the locomotor muscles, the stabilizer muscles, as well as through muscle reflex activity and tendons (Kibele et al., 2015). In contrast to young athletes, older adults avoid situations impeded by instability to exclude, or at least reduce, a possible risk of falling. So, why should IRT be beneficial for an older adult? This short report aims to clarify the applications and the benefits of IRT for senior citizens.

› **Existing studies comparing IRT to traditional resistance training (RT)** on stable surfaces will be reviewed and summarized while discussing pros and cons to forward evidence based suggestions. In particular, we will emphasize that IRT a) is safe for the older adult when properly introduced and supervised (Eckardt, 2016; Eckardt et al. 2020)), b) requires smaller training loads and stresses larger joint surfaces while providing similar gains in strength and dynamic balance as traditional RT on stable surfaces (Eckardt, 2016; Torres Piraua et al., 2019), c) provides extended gains in functional mobility and reduced concerns about falling (Torres Piraua et al., 2019), d) offers a strengthening of stabilizer muscles whose strength loss is expected to facilitate falls (Kibele, 2016; Daun & Kibele, 2019), e) stabilizes gait performance and, thus, reduces the risk of falls (Eckardt & Rosenblatt, 2019), f) improves executive functions (Eckardt et al. 2020) possibly through an increased release of dopamine and/or through an increase in attentional resources.

› **Moreover,** it was shown that IRT is particularly beneficial for Parkinson patients (Silva-Batista et al. 2016, 2017, 2018). In summary, it appears that IRT could be a very useful tool for the physical conditioning of older adults.

NR. 286 OP-20-001 ATHLETES, SEM SUPPORT AND PERFORMANCE

Breitbart, P[1], Meister, S[2], Gärtner, B[3], Meyer, T[4]

Incidence and Prevalence of Borrelia Burgdorferi Antibodies in male professional Football Players

1. SAARLAND UNIVERSITY, *Institute of Sports and Preventive Medicine, Saarbrücken*
2. SPORTMEDIZIN MÜNCHEN, *Munich*
3. UNIVERSITÄTSKLINIKUM DES SAARLANDES
4. UNIVERSITÄT DES SAARLANDES

› **Background:** Infections with Borrelia burgdorferi can cause Lyme disease with multiorganic involvement like (myo-)carditis or joint manifestations. Musculoskeletal complaints possibly mimicking some of these symptoms are common among elite athletes. Data on epidemiology of antibodies against Borrelia burgdorferi are limited to some outdoor activities as running or mountain biking. This study aimed to determine seroprevalence and seroconversion rate over one season of Borrelia burgdorferi antibodies in healthy, asymptomatic professional football players.

› **Methods:** Baseline venous blood samples were taken from 535 male elite football players participating in the first and second German league and examined for signs of earlier infections with Borrelia burgdorferi. At least one further blood examination was accomplished in 452 players. Two screening assays were used to examine immunoglobulin M (IgM) and G (IgG) against Borrelia burgdorferi: an enzyme immunoassay (EIA) and a chemiluminescence assay (CLIA). In case of a positive or equivocal result an immunoblot including in vivo antigens was carried out. Prevalence was determined as a positive IgG-result in one of the screening and confirmation assay of the first blood sample. Incidence was estimated by the rate of seroconversion of initial seronegative individuals.

› **Results:** 96.4% of all results were concordant between EIA and CLIA. Considering only samples with identical results in both assays, prevalence was 1.6%. A positive IgM was detected in 2.3%. No player showed any symptoms of Lyme disease. A seroconversion to IgG was not found. Three players developed a positive IgM corresponding to an incidence of 1,032/100,000 person years. Depending on the assay, 49% to 75% of positive or equivocal screening results could not be confirmed by immunoblot.

› **Conclusions:** Seroprevalence and incidence of Borrelia burgdorferi among healthy male professional football players are low. Therefore, infections with Borrelia burgdorferi has to be regarded a rare differential diagnosis in professional football in Central Europe. The low confirmation rate of positive screening assays points to an unspecific immune activation. This study was sponsored by the Deutsche Fußball Liga (DFL).

NR. 287 OP-20-002 ATHLETES, SEM SUPPORT AND PERFORMANCE

Keller, K[1], Hobohm, L[2], Schmitt, V H[2], Engelhardt, M[3], Post, F[4], Münzel, T[2], Gori, T[2], Wenzel, P[2], Friedmann-Bette, B[5]

Total Numbers and in-hospital Mortality of Patients with Myocardial Infarction during the Soccer World Cup 2014 – Results from the German nationwide inpatient Sample

1. UNIKLINIK HEIDELBERG, *Medizinische Klinik VII: Sportmedizin*
2. UNIVERSITÄTSMEDIZIN MAINZ, *Zentrum für Kardiologie, Kardiologie I*
3. KLINIKUM OSNABRÜCK, *Klinik für Orthopädie und Sportmedizin*
4. KATHOLISCHES KLINIKUM KOBLENZ, *Klinik Allgemeine Innere Medizin/Kardiologie*
5. UNIKLINIK HEIDELBERG, *Innere Medizin VII: Sportmedizin*

› **Background**: Environmental stress can be induced by catastrophes, but also sporting events may affect cardiovascular diseases. Soccer is a known cause of acute stress, excitement and anger particularly in soccer-focused countries like Germany. Thus, we aimed to investigate i) whether the soccer world cup 2014 had an impact on total numbers and in-hospital mortality of patients with myocardial infarction (MI) in Germany and ii) whether the soccer games of the German national team influenced the number of admissions and mortality.

› **Methods**: We analyzed data of MI patients of the German nationwide inpatient sample (2014-2015). Patients admitted due to MI during soccer world cup 2014 (12th June to 13th July 2014) were compared to those during the comparison-period 2015 (12th June to 13th July 2015) without soccer world cup (source: RDC of the Federal Statistical Office and the Statistical Offices of the federal states, DRG Statistics 2014-2015, and own calculations).

› **Results**: Overall, the total number of MI patients was higher during world cup 2014 than in the comparison-period 2015 (18,479 vs. 17,794, 3.7% more patients). Patient characteristics did not differ between both groups. In contrast, drug eluting stent implantations were more often performed during the comparison-period 2015 than during world cup 2014 (50.0% vs. 44.5%, P<0.001), whereas rate of percutaneous coronary intervention (P=0.144) was balanced. In-hospital mortality rate was comparable between both periods (8.3% vs. 8.4%, P=0.892). During the world cup 2014, in-hospital mortality rate was not affected by the games of the German national team (8.9% vs. 8.1%, P=0.110). However, we observed an increase of the in-hospital mortality rate from 7.9%-9.3% before to 12.0% at the final. Nevertheless, neither significant increase of total numbers (β -0.006 (95%CI -0.026 to 0.015), P=0.502) nor of in-hospital death (β -0.0003 (95%CI -0.0009 to 0.0004), P=0.416) during the German games throughout the world cup could be detected.

› **Conclusions**: Number of admissions due to MI in Germany was 3.7% higher during the 2014 soccer world cup in comparison to the comparison-period 2015. While in-hospital mortality of MI was not affected by the soccer world cup, the in-hospital mortality was highest at the world cup final.

NR. 288 OP-20-003 ATHLETES, SEM SUPPORT AND PERFORMANCE

Sukhareva, N[1]

Risk Evaluation of Female Athlete Triad Disorders among Handball Players and Creation of Algorithm for further focused Medical Examinations

1. MOSCOW STATE COLLEGE OF OLYMPIC RESERVE

› **Background**: The female athlete triad is a syndrome frequently observed among female athletes involving three interrelated components: low energy availability (with or without eating disorder), menstrual dysfunction and impaired bone health. These conditions are not always reversible and negatively affect athlete's health and performance. Development of screening tools for risk assessment for triad disorders and the need for further in-depth medical examinations is an urgent task at the present time.

› **Methods**: 17 female handball players, age 15-19, filled out the questionnaire which comprised questions about athlete's age, height and weight (including questions about sharp fluctuations of body weight); the age of menarche; the number of menstrual cycles per year; the history of stress or traumatic fractures; a number of questions about athlete's dietary behavior and her attitude to her own body and weight. Before the start of research, athletes were familiarized with educational materials about female triad syndrome, its negative consequences, prevention methods and importance of early detection. Depending on the answer, a certain number of points was assigned to each question in order to quantify the risk degree for each triad component. In accordance with the developed risk scale, the risk degree of occurrence of each triad disorder (low, medium or high) has been evaluated for each athlete. The algorithm has been created for conducting in-depth medical examinations of female athletes, depending on the risk degree of female athlete disorders. The algorithm was based on survey results and on the outcomes of previous research about triad.

› **Results**: 13 of female handball players (76%) were at medium or high risk of one or several triad disorders. For these athletes, in accordance with the algorithm, specific recommendations were provided for further focused medical examinations.

› **Conclusion**: The tools developed during the research (questionnaire, educational materials, algorithm) are intended for use by specialists working with athletes (coaches, health care professionals, etc.) for early detection and prevention of the triad disorders.

NR. 289 OP-20-004 ATHLETES, SEM SUPPORT AND PERFORMANCE

Venzke, J[1], Platen, P[2]

Metabolic Power, Match Running Performance and Sucess in the German Soccer Bundesliga

1. RUHR-UNIVERSITÄT BOCHUM, *Departement of Sports Medicine and Sports Nutrition*
2. RUHR-UNIVERSITÄT BOCHUM, *Lehrstuhl für Sportmedizin & Sporternährung*

› **Introduction:** Activity in soccer is characterized by a series of accelerations and decelerations of varying magnitudes and durations. Research claims that the classification of intensity and volume of in-game performance out of speed zones is not suitable anymore. Metabolic power (MP) which takes into account acceleration could provide a proper view on individual performance. The aims were: (1) to compare the traditional speed-zone with the metabolic power approach; and (2) evaluate the association between metabolic power data and team success.
› **Methods:** 1344 video match analysis (25Hz) datasets from 416 players (182,3±6,7cm, 77,1±7,0kg, 25,8±3,9y) out of 96 matches of the German Bundesliga were gathered by an automatic player detection and tracking system. Displacement and energetic variables were determined and intensity was classified utilizing conventional thresholds. Time spent, distance covered and energy expended at high speed (>15,5 km/h) was compared to those at high metabolic power (>20W/kg). Teams were grouped according to their final position at the end of the season (Top=Best 4; Bot=Worst 4; Mid=8-11). Also the relationship between match outcome (Win, Draw and Loss) and metabolic data was analyzed.
› **Results:** Less time (t) was spent and less energy (EE) was expended at high speed (t: 302±84s; EE: 7,18±1.98kJ/kg) when compared to high MP (t: 377±78s; EE: 11,59±2,37kJ/kg) (p<0.001). Players covered more distance at high speed (1638±148m) than at high MP (1593±360m) (p<0,001). Teams who lost spent more time at high speed (55±6min vs. 52±5min), at high MP (68±5 vs.65±4min) and covered more distance (17,4±1,4km vs. 16,5±1,2km) than teams who tied. Top and winnings teams maintained more possessions of the ball and completed more passes than Mid, Bot, loosing and drawing teams (p<0,001).
› **Discussion:** Data show displacement variables can help to understand the different movement patterns, however, these parameters underestimate the amount of high-intensity activities. Therefore, metabolic power rather than displacement variables should be used for the determination of the metabolic demands of soccer. There is no running nor metabolic power parameter that is important for achieving success in the German Soccer Bundesliga, but rather the technical and tactical elements of the modern game are related to achieving success.

NR. 290 OP-21-001 ONCOLOGY

Bizjak, D A[1], Schulz, S[1], Schumann, U[1], Otto, S[1], Kirsten, J[1], Ebner, F[2], Huober, J[2], Janni, W[2], Steinacker, J[1]

Beneficial molecular Adaptations in BRCA1-Mutation carriers by combined HIT/HIRT Intervention: Results from a Pilot Study.

1. ULM UNIVERSITY HOSPITAL, *Division of Sports and Rehabilitation Medicine, Ulm*
2. ULM UNIVERSITY HOSPITAL, *Department of Gynecology and Obstetrics, Ulm*

› **Background:** Exercise is known to reduce breast cancer risk in women with BRCA mutation. Since BRCA mutation carriers have a 55-60% increased incidence for breast cancer development, we examined the influence of regular exercise in human BRCA mutation carriers on their BRCA1 gene/protein expression and inflammatory/oxidative response based on growing evidence that BRCA also plays a pivotal role in the regulation of skeletal muscle metabolism and the response to anti-oxidative stress.
› **Methods:** Sixteen BRCA-mutation carriers (13w, 3m) were assigned to an intervention (IG, n=10) or control group (CG, n=6). IG received a combination of high-intensity interval endurance (HIT) and strength training (HIRT) for six weeks, whereas CG received a low intensity activity program for the same time period. Before (T0) and at the end of the intervention (T1), muscle biopsy, physiological performance, blood withdrawal and anthropometry were obtained. Parameters included: Muscle BRCA1 gene and protein expression, inflammatory and oxidative stress (i.e. cytokines IL-2R, GDF-15, TNF-α, IL-6, IL-1β, IL-10 and malondialdehyde (MDA)), anti-oxidative capacity (i.e. Thiol status, C-reactive protein (CRP)), peak oxygen capacity (VO2peak) and 1-repetition maximum (1-RM) at six different training machines.
› **Results:** VO2peak (p=0,001) and 1-RM (pmean=0,007) of IG were increased at T1 compared to T0, whereas CG performance parameters remained unchanged. IG showed increased BRCA1 protein concentration (p<0.001) as well as anti-oxidative capacity (CRP p=0,05; Thiol p=0,009), whereas gene expression was unaltered. IG inflammatory and oxidative damage reflected by all tested cytokines and MDA formation respectively, did not differ between time points. CG physiological and molecular parameters remained unchanged during the intervention.
› **Conclusions:** Combined HIT/HIRT increases aerobic and strength performance of BRCA-mutation carriers with positive impacts on BRCA1 protein expression and anti-oxidative status without showing an increased inflammatory response and may therefore be considered a prospective treatment method to reduce the risk for the development of cancer in individuals with BRCA1 mutations.

NR. 291 OP-21-002 ONCOLOGY

Freitag, N[1], Bloch, W[1], Schumann, M[1]

Short-Term High-Intensity Interval Training during Chemotherapy does not improve Physical Function and Quality of Life

1. GERMAN SPORT UNIVERSITY, *Institute of Cardiovascular Research and Sports Medicine, Department of Molecular and Cellular Sport Medicine*

› **Background:** High-intensity interval training (HIIT) is a safe and effective method of exercise medicine in chronic diseases, such as heart failure, diabetes mellitus and cancer. However, the majority of studies utilizing HIIT in cancer were conducted in aftercare. Therefore, the evidence about physiological effects of HIIT during therapy (i.e. chemotherapy) is limited. The purpose of this pilot-study was to investigate the feasibility, safety, physiological effects and quality of life (QoL) of HIIT compared to usual care (UC) in cancer patients undergoing adjuvant chemotherapy.
› **Methods:** 27 patients were randomized into HIIT (n=16; 11 females; 51.3±13.6yrs.; 71.9±14.0kg) or UC (n=11; 6 females; 51.5±12.3yrs.; 74.3±18.3kg). Patients were diagnosed with either breast (HIIT:10, UC:4), gastrointestinal (HIIT:5, UC:5) or prostate (HIIT:2, UC:1) cancer. Training started within the first (HIIT:9, UC:7) or second cycle (HIIT:7, UC:4) of chemotherapy and included eight sessions, initially planned twice weekly over four weeks (5x2 minutes at 80% of PPO, 3-minute rest at 40% PPO). Measures included adherence (% of total training-time), safety (adverse events), peak power (PPO) and peak oxygen consumption (VO2peak) during an incremental bike ergometer test as well as questionnaire-assessed QoL (EORTC-QLQ-C30).
› **Results:** Training adherence was 95.7±12.1%. No HIIT-related adverse events were reported. The duration of the intervention was similar with 51.3±13.6 and 51.5±12.3 days in HIIT and UC, but longer than the originally scheduled time. PPO remained statistically unaltered both in HIIT (-4.0±10.7%, p>0.05) and UC (-2.0±5.2%, p>0.05). VO2peak similarly decreased in HIIT (-10.9±10.9%, p<0.01) and UC (-9.1±8.1%, p<0.01). Although no statistical difference was observed in QoL, HIIT improved by 4.0±19.5 while UC was reduced by 5.0±12.5 points (p>0.05). None of the remaining functional or symptom-scales such as physical and cognitive functioning or fatigue, dyspnea or pain indicated statistical time or interaction effects.
› **Conclusion:** Our results imply that HIIT seems to be feasible and safe for patients undergoing adjuvant chemotherapy. However, eight HIIT sessions might not be sufficient to maintain physical functioning or subjective perceived QoL throughout the initial phases of chemotherapy, partly explained by the irregular training frequency. Future studies should focus on methods to improve regular training participation during targeted therapy, e.g. through periodization.

NR. 292 OP-21-003 ONCOLOGY

Sabine Kesting[1], Dominik Gaser[1], Christiane Peters[2], Irene von Luettichau[3] and Renate Oberhoffer-Fritz[2]

Instructed Sports Therapy In Pediatric Oncology - It's A Matter Of Continuity

1. TECHNICAL UNIVERSITY OF MUNICH, *Institute of Preventive Pediatrics, Department of Sport and Health Sciences and Technical University of Munich, Kinderklinik München Schwabing, TUM School of Medicine, Department of Pediatrics and Childrens's Cancer Research Center, Munich, Germany*
2. TECHNICAL UNIVERSITY OF MUNICH, *Institute of Preventive Pediatrics, Department of Sport and Health Sciences, Munich, Germany*
3. TECHNICAL UNIVERSITY OF MUNICH, *Kinderklinik München Schwabing, TUM School of Medicine, Department of Pediatrics and Childrens's Cancer Research Center, Munich, Germany*

› **Background:** The diagnosis of pediatric cancer is usually associated with continuous reduction of physical activity, fitness and motor performance. Following treatment, disease- and therapy-related sequelae partly linked to inactivity and barriers of reintegration into sports structures become obvious.
› **Methods:** The concept of accompanying sports therapy from diagnosis to aftercare was implemented in June 2016 at our institution. Aiming at a translational and interdisciplinary approach, we provide a close connection between physical activity and exercise, physiotherapy, psychosocial care and medical treatment. A "bridging strategy" covers exercise-related care from in- and outpatient treatment to the return to normality.
› **Results:** Pediatric cancer patients (2-18 years, mixed types of cancer) are participating in our project consisting of daily exercise programs, sports groups, outdoor sports, consultation and support. Since the beginning, 191 different patients, aged 9.1±4.5 years, participated. In 1.911 exercise sessions (57% inpatient), provided by two part-time exercise physiologists, participants trained 28±16 minutes on average. Offers are specifically tailored with respect to medical conditions, age, interests and individual capacities. Continuity is ensured due to regular and individually adapted interventions, supervision and personal contact during all phases of treatment. This concept combines the principles of individuality and a holistic approach including the principles of flexibility, versatility, inclusion and increase of the patient's own competence.
› **Conclusion:** Continuous exercise interventions and support is an important matter to maintain physical activity, motor performance and fitness as well as mobility and autonomy during and after treatment for a pediatric oncological disease. We aim at providing early information on beneficial effects of physical activity close to diagnosis to encourage participation in our offers, support autonomous engagement in exercise during home stays and the development of a long-term active lifestyle to reduce the risk of late effects due to physical inactivity.

NR. 293 OP-21-004 ONCOLOGY

Grusdat, N[1], Stäuber, A[2], Tolkmitt, M[3], Schnabel, J[3], Schubotz, B[4], Heydenreich, M[5], Zermann, D[5], Schulz, H[6]

Physical Function, Mental health and Critical Prognostic Values in younger Woman with Breast Cancer prior and post Cancer Therapy

1. CHEMNITZ UNIVERSITY OF TECHNOLOGY, *Professorship of Sports Medicine/Sports Biology*
2. TECHNISCHE UNIVERSITÄT CHEMNITZ
3. DRK KRANKENHAUS CHEMNITZ-RABENSTEIN, *Brustkrebszentrum*
4. KLINISCHES KREBSREGISTER CHEMNITZ
5. VOGTLAND-KLINIK / BAD ELSTER
6. TECHNISCHE UNIVERSITÄT CHEMNITZ, *Professur Sportmedizin/-biologie*

› **Purpose**: A reduced functional and mental status in breast cancer patients may indicate a lower resilience throughout the different stages of cancer treatment and a worse prognosis for mortality in the phase of survivorship. Aim of this study was to find out the prevalence of critical values of functional and mental health in woman younger than 50 years prior and post cancer therapy.
› **Methods**: 19 women with breast cancer (42±5 yr) (UICC: IA=42%, IIA=53%, IIB=5%; Her2/neu status: 5%=positive, 95%=negative, HR status: 84%=positive, 16%=negative) were examined on the day of diagnosis (T0) and at the end of medical cancer therapy (T1) (type of therapy: chemotherapy=68%, surgery=95%, radiation therapy=37%, hormone therapy=74%). Standardized assessment of functional status included a handgrip strength test (HGS), 6-Minute-Walk-Test (6MWT) and bioimpedance analysis for detection of bioimpedance phase angle (pA). The mental status was investigated using the Hospital Anxiety and Depression Scale (HADS-A/HADS-D) questionnaire.
› **Results**: At T0, 26% of patients presented a critical HGS below individual cutoff which changed to 42% at T1. In 11% of patients a critical pA was detected at T0 which changed to 53% at T1. Within the 6MWT a distance lower than the individual predicted value was found in 79% of the patients at T0 with no relevant change at T1. Clinically relevant anxiety scores (HADS-A score >10) have been diagnosed in 47% at T0 and 26% at T1. Clinically relevant depression scores (HADS-D score >10) were seen in 32% of patients at T0 with a decrease to 21% at T1. Moreover, 21% of patients presented a severe form of anxiety (HADS-A score = 15-21) at T0 with a change to 11% at T1. Severe depression scores (HADS-D score = 15-21) were diagnosed in 11% at T0 and T1.
› **Conclusion**: The data provides knowledge about critical prognostic values of functional and mental health status in younger woman with breast cancer. The potential risk factors suggest the adaptation and individualization of medical treatment. Routine assessments may give the option to conduct a risk stratification. This could affect the ongoing process of therapy and its outcome in the different stages of cancer treatment.

NR. 294 OP-21-005 ONCOLOGY

Kirsten, J[1], Wais, V[2], Schulz, S[1], Bunjes, D[2], Steinacker, J[1]

Changes of Body Composition and Physical Fitness during allogenic Stem Cell Transplantation Treatment

1. DIVISION OF SPORTS AND REHABILITATION MEDICINE, *Center for Internal Medicine, Ulm University Medical Center*
2. UNIT FOR ALLOGENEIC BLOOD STEM CELL AND BONE MARROW TRANSPLANTS, *Clinic for Internal Medicine III, Ulm University Medical Center*

› **Background:** Allogenic hematopoietic stem cell transplantation (aHSCT) is the only curative treatment option for a variety of hematological diseases and usually performed after multiple previous treatments. Although therapy-associated side effects of aHSCT have been successfully reduced by optimized therapy regimes in recent years, morbidity and mortality remains high. The aim of this sub-study was testing the changes in body composition, muscle strength and cardiopulmonary exercise capacity in patients before and after the hospitalization period for aHSCT.
› **Methods:** Between April 2018 and October 2019 all patients scheduled for aHSCT in Ulm University Medical Center, were screened for sarcopenia (total number 135 patients). The standardized assessment included measurement of total muscle mass using body impedance analysis (BIA), measurement of grip-strength and cardiopulmonary exercise testing (CPET) on the cycle ergometer until exhaustion, with continuous measurement of oxygen uptake (VO2). Until October 2019 a sub-group of 41 patients (m= 24, f= 17) volunteered to repeat the examination after aHSCT.
› **Results:** The rescreening took place 122 days on average after aHSCT. There was a significant decrease in body weight (-4,3%, $p \leq 0,01$), skeletal muscle mass (-7,7%, $p \leq 0,01$) and grip strength (-13,3%, $p \leq 0,01$). There was no recovery of the low VO2 values observed before aHSCT, despite hemoglobin concentrations being significantly higher (24,4%, $p \leq 0,01$) after aHSCT. Phase Angle (PA) acquired by BIA as a marker for tissue stability and nutrition status was significantly lower after aHSCT (-11%, $p \leq 0,01$).
› **Conclusion:** During the allogenic transplantation period there was a significant weight loss mainly attributed to loss of skeletal muscle mass. Consecutively patients strength and exercise capacity declined. Causes are most likely multifactorial, including drug treatment, immobilization, graft versus host disease, malnutrition or malabsorption. This poses the question, if sports therapy accompanied by monitoring of adequate nutrition could be a reasonable intervention strategy to improve performance status of patients after aHSCT, enabling faster reintegration in activities of daily living.

NR. 295 OP-22-001 INJURIES AND SPORTS

Hollander, K[1], Outerleys, J[1], Johnson, C D[1], Davis, I S[1]

Biomechanical Determinants of Running Injuries according to their Locations in 550 injured Runners

1. HARVARD MEDICAL SCHOOL, *Department of Physical Medicine and Rehabilitation, Spaulding National Running Center*

› **Background**: The etiology of running related injuries is multifactorial, with biomechanical factors playing an important role. Most previous studies have reported biomechanical differences between healthy and injured runners. However, none have examined the relative differences in biomechanics between different injuries. Therefore, the aim of this study was to examine the relative differences of four commonly assessed biomechanical variables between specific locations of running injuries.
› **Method**: Five hundred and fifty diagnosed injured runners (49.6% female, mean±SD age 37.0 ± 12.8 years, BMI 23.3 ± 3.0 kg/m2) were clinically assessed to determine the injury location according to a current consensus statement on reporting injuries. After a clinical assessment, all underwent an instrumented treadmill analysis at a self-selected speed (10.3 ± 1.4 km/h) to determine cadence, foot strike pattern, peak vertical ground reaction forces and vertical loading rates. A logistic regression model was used to determine associations between these outcomes parameters and running related injuries according to their location.
› **Results**: Most injuries were diagnosed at the knee (n=141, 25.6%), shank (n=119, 21.6%), foot/toes (n=85, 15.5%) and hip (n=71, 12.9%). A midfoot strike pattern was associated with an increased risk of injuries to the Achilles tendon (OR 2.27; 90%CI 1.17 to 4.41; p=0.042) and a forefoot strike pattern with injuries to the posterior calf (OR 2.59; 90%CI 1.50 to 4.47; p=0.004). Hip injuries were more frequently seen in runners with high peak vertical ground reaction forces (OR 1.14; 90%CI 1.05 to 1.24; p=0.012). All other biomechanical outcomes were not associated with any injury locations.
› **Conclusion**: From the four modifiable biomechanical variables, only distinct foot strike patterns were associated with injuries to the Achilles tendon (midfoot strike) or posterior calf (forefoot strike) when compared to the re Einfluss unerwünschter Ereignisse auf Effekte von Akning group of injured runners. These results suggest that most of the investigated biomechanical variables do not distinguish well between different sites of injuries and prospective studies are needed to investigate potential for injury prevention and rehabilitation.

NR. 296 OP-22-002 INJURIES AND SPORTS

Kuhn, L[1], Wearing, S[1], Brauner, T[2], Horstmann, T[3]

Does short-term local Vibration of the Quadriceps Muscles decrease Patellar Tendon Loading?

1. QUEENSLAND UNIVERSITY OF TECHNOLOGY, *School of Clinical Sciences & Institute of Health and Biomedical Innovation; TU München, Konservative und Rehabilitative Orthopädie*
2. DEUTSCHE HOCHSCHULE FÜR GESUNDHEIT UND SPORT
3. TU MÜNCHEN, *Konservative und Rehabilitative Orthopädie; Medical Park Bad Wiessee St. Hubertus*

› **Elevated resting muscle activity** has been implicated in patellar tendinopathy. Local vibration of the quadriceps muscles has been shown by some studies to decrease muscle activation and maximal voluntary contraction of the knee extensors. Therefore, this study aimed to investigate the effects of short-term local vibration of the quadriceps muscles on patellar tendon loading in adults with patellar tendinopathy and healthy controls.
› **A noninvasive ultrasonic transmission technique** was used to determine axial ultrasonic velocity, a surrogate measure of the elastic modulus, in the patellar tendon during quiet sitting. It was hypothesized that short-term local vibration of the quadriceps muscles will alter the ultrasound transmission velocity in symptomatic patellar tendons more than in healthy tendons. Axial ultrasonic velocity in the patellar tendon was measured before and after two and five minutes of local vibration (25 Hz) applied to the quadriceps muscles. Mixed-design ANOVAs were used for statistical comparison between healthy and injured tendon.
› **This project is ongoing and will present** the results of the effect of short-term local vibration on axial velocity of the patellar tendon. Preliminary results suggest that the vibration of the quadriceps muscle group may decrease the loading in symptomatic patellar tendon and hence the elevated resting muscle activity. Although further research is needed, these initial results suggest that local quadriceps vibration may lower muscle tone and reduced tendon loading, which might be helpful in the treatment and rehabilitation of symptomatic patellar tendinopathy.

NR. 297 OP-22-003 INJURIES AND SPORTS

Schaefer, L[1], Bittmann, F N[1]

The preloaded Achilles tendon shows a reduced Variability in Mechanical Oscillations after Impact in Patients with Achilles Tendinopathy compared to Healthy Controls

1. UNIVERSITY OF POTSDAM, *Regulative Physiology and Prevention*

› **Introduction**: The pathogenesis of Achilles tendinopathies (AT) is unclear. One of the most quoted factors is the 'overuse'-theory, which seems to be implausible in many cases. Certainly, a correlation between complaints and physical strain exists. However, the relation between load and resilience might be more important. It is assumed that particular conditions could affect the functionality of muscular control, which might overstress the muscle-tendon-unit under high loads. It is hypothesized that the variability of mechanical oscillations of the Achilles tendon is reduced in tendinopathy. This is investigated in a setting close to daily motion and sports.
› **Method**: The mechanical oscillations of the preloaded Achilles tendon are recorded in ten AT-patients (AT) and ten controls (Con) by the innovative method of Mechanotendography (MTG) using a piezo-electric sensor during an impulse-like pressure impact, which is applied on the forefoot from plantar, while the subject stands upright on the ball of one foot. The MTG-sensor is fixed 5mm above the cranial insertion of the Achilles tendon. Five trials were conducted per side. The raw MTG and pressure signals were cut into two intervals after impulse start. For analysing the intrapersonal variability, the averaged Spearman rank correlation (MCC) and the normalized averaged mean distances (MD), respectively, of the five trials were calculated and compared between groups.
› **Results**: The AT show a significantly reduced variability in MTG compared to Con (MCC: 70ms-interval p=.006, 100ms-interval p=.011; MD: 70ms-intervals p=.026, 100ms-interval p=.028). The 95%-CI of the MCC ranges from 0.17 to 0.63 in Con, whereas in AT from 0.77 to 0.89. The 95%-CIs are clearly disjoint. The pressure signals do not differ significantly (p=.192–.601).
› **Discussion**: The reduced variability of the mechanical oscillations of Achilles tendon in AT might reflect an impaired function of the muscle-tendon-unit in reaction to an impulse-like external impact under load. Alternative explanations, e.g. relating altered tendon structures, have to be considered. The question remains, if this changed pattern occurs after developing complaints or already in advance. If these findings will be underpinned by further studies, the presented method could be a supportive tool to characterize an affected function of the Achilles tendon.

NR. 298 OP-22-004 INJURIES AND SPORTS

Asgari, M, Alizadeh, S[1], Sendt, A[2], Jaitner, T[2]

Is the Functional Movement Screening (FMS) an appropriate Tool for Injury Prediction among Female Athletes? A Systematic Narrative Review

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2. TECHNISCHE UNIVERSITÄT DORTMUND, *Institut für Sport und Sportwissenschaft*

› **Background:** Although gender has found to be a significant variable on the FMS studies, validity of the FMS in identifying injury predisposed female athletes has not been individually reviewed yet.
› **Objective:** To systematically review female-oriented literature pertained to capability of the FMS in identification of female athletes who are prone to injury.
› **Design:** Systematic review.
› **Data sources:** Six online databases of PubMed, Medline, Web of Science, Science direct, Sport Discus and Google Scholar were searched for the period of April 2006 to May, 2020.
› **Study selection:** Out of the 59 aggregated references 23 were reviewed in detail validating inclusion criteria; ten were further included to the study. The risk of bias, applicability as well as level of studies were then calculated using the QUADAS-2 and a checklist for assessing methodological quality.
› **Data extraction:** The following data was derived from the references: year of publication, title, study type, participants, sample size, FMS cut-off point, injury definition, statistical analysis, FMS results and the level of studies.
› **Results:** Generally, the quality of studies was poor concerning both small sample sizes and short follow up period. Except a study on defensive forces, all surveis was carried out on team sports. Overall bias for the studies was low but an unclear amount of bias for participant selection. Four studies reported inability of the FMS in injury prediction while three defended its prediction validity; the rest were partially supported predictive validity of the FMS. Although reliability of the given cutoff point was proved, higher cutpoints than 14 were significantly associated with the predicting potential of the FMS.
› **Conclusion:** Overall, albeit reliable for clinical practice, significant concerns remain regarding validity of the FMS to identify at risk female athletes. The FMS, However, seems to be a more valid tool for injury prediction among female athletes than the males. Given the poor and contradict current female-oriented literature, further well-organized studies with a better sample size and monitoring period is highly recommended.

NR. 299 OP-22-005 INJURIES AND SPORTS

Helmich, I[1], Lausberg, H[1]

Sport-Related Concussions alter Gestural Functions

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› **Background**: Symptoms after sport-related concussions (SRC) are common. Because post-concussion symptoms are often not clearly visible, speech-accompanying gestures may help clinicians to gain additional information about the patient's history and symptoms during medical consultation. We hypothesized that athletes with SRC and who suffered from persisting symptoms would display more gestures during concussion assessment protocols when compared to non-concussed athletes because of the athletes' previous motor-sensory experiences made during the concussive event.
› **Methods**: A retrospective cross-sectional study. Methods: Three matched groups of 40 (active) athletes were investigated in the context of concussion assessment (/and baseline) protocols: 14 symptomatic and 14 asymptomatic athletes with a SRC, and 12 non-concussed athletes. Certified raters using a standard analysis system for nonverbal behaviour analysed videotaped hand movements and gestures during a standardized concussion assessment protocol.
› **Results**: Symptomatic athletes spent significantly more time with in space hand movements, i.e., movements that act in the body-external free space without touching anything and specifically, motion quality presentation gestures than non-concussed athletes.
› **Conclusion**: Increased in space movements, which are functionally gestures, and specifically, motion quality presentation gestures in symptomatic athletes indicate that the more vivid sensory motor experience of the head trauma is reflected in more gestural expressions. Thus, hand movements and gestures differentiate athletes who suffer from post-concussion symptoms from non-concussed athletes indicating the athletes' motor-sensory experiences of the event and its aftereffects.

NR. 300 PS-24-003 COVID

Widmann, M[1] Schubert, I[1], Jürgens, S[2], Nieß, A M[1], Burgstahler, C[1]

Covid-19 im Leistungssport – Eine Fragebogenerhebung

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2. UNIVERSITÄTSKLINIKUM TÜBINGEN, *Institut für Medizinische Virologie und Epidemiologie der Viruskrankheiten*

› **Hintergrund:** Eine Infektion mit SARS-CoV-2 geht meistens mit einem milden Verlauf einher, kann allerdings auch schwere Verläufe bis hin zur Todesfolge mit sich bringen. Junge, aktive Leistungssporttreibende zählen nach aktuellem Kenntnisstand nicht zur Risikogruppe. Ein milder oder asymptomatischer Verlauf ist hier relativ wahrscheinlich. Unklar ist allerdings bisher, welche Durchseuchungsrate bei KadersportlerInnen besteht.
› **Methode:** KadersportlerInnen, die sich routinemäßig zu ihrer Jahreshauptuntersuchung in unserer Abteilung vorstellen, werden in die Studie seit Juni 2020 eingeschlossen. Zusätzlich zu den nationalen und internationalen Standards sportmedizinischer Untersuchungen erfolgt eine Antikörpertestung - sowie eine Fragebogenerhebung im Hinblick auf mögliche Covid-Symptome oder Risikokontakte.
› **Ergebnisse:** Bisher wurden 350 KaderathletenInnen in die Studie eingeschlossen (m,w; Alter 17,5 ± 3,8J). 37/350 (10,6%) Athleten waren aufgrund eines Kontaktes zu einer positiv getesteten Person in Quarantäne. 346 der Befragten gaben an, bisher keine Infektion mit SARS-CoV2 durchgemacht zu haben. Lediglich zwei Personen hatten einen gesicherten positiven AK-Test im Vorfeld an die Befragung. Der Nachweis einer Infektion, gesichert durch eine positive PCR wurde von einer Person angegeben. Bisher wurden 267 der 350 Teilnehmer serologisch auf AK getestet. Bei 5/267 (1,8%) Personen konnten IgG-AK gegen SARS-CoV-2 im Blut nachgewiesen werden.
› **Schlussfolgerung:** Die Spätfolgen und auch die Dunkelziffern der Corona-Pandemie sind nach wie vor relativ unklar. Die Studie soll dabei helfen herauszufinden, wie hoch die Durchseuchungsrate im Kollektiv von Kaderathletinnen und –athleten ist und sich auch im zeitlichen Verlauf ändert. Erste Daten legen nahe, dass die Durchseuchung in der untersuchten Kohorte relativ gering ist. Allerdings muss davon ausgegangen werden, dass Antikörper nach einer durchgemachten Infektion nur bei einem Teil der Infizierten über einen längeren Zeitraum nachweisbar sind. Die Dunkelziffer könnte daher höher sein als angenommen. Möglicherweise erlauben sensitivere AK-Tests hier in Zukunft validere Aussagen.
›

NR. 301 PS-24-004 COVID

Füzéki, E[1] Schröder, J[2], Carraro, N[3], Merlo, L[3], Reer, R[2], Gronberg, D[1], Banzer, W[1]

Physical Activity during the first Covid-19 related lockdown in Italy

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2. UNIVERSITÄT HAMBURG
3. SPORTS AND EXERCISE MEDICINE UNIT, *Azienda ULSS 2 Marca Trevigiana*

› **The spread of the Covid-19 virus** was met by strict lockdown in many countries around the world, with the closure of all physical activity facilities and limiting moving around freely. The aim of the present online survey was to assess the effect of lockdown on physical activity in Italy. Physical activity was assessed using the European Health Interview Survey Questionnaire. 1500 datasets were analyzed. Differences between conditions were tested with Chi²-based (X^2 test) for categorical variables, and with the Student's t-test for paired data. A fixed effects binary logistic regression analysis was conducted to identify relevant predictor variables to explain the compliance with WHO recommendations. We found a substantial decline in all physical activity measures. Mean differences in walking and cycling METmin/week respectively were 344.4 (95% confidence interval (95% CI): 306.6-382.2; p<.001.) and 148.5 (95% CI: 123.6-173.5; p<.001). Time spent in leisure time decreased from 160.8 to 112.6 min/week (mean difference 48.2; 95% CI: 40.4-56.0; p<.001). Compliance with WHO recommendations decreased from 34.9% to 24.6% (chi² [1, 3000] = 38.306, p < .001, V = 0.11). Logistic regression showed a reduced chance (OR 0.640, 95% CI 0.484–0.845; p=.001) to comply with WHO PA recommendations under the lockdown condition. Measures to promote physical activity should be intensified to limit detrimental health effects.

NR. 302 PS-24-005 COVID

Bretthauer, B[1] Kubosch, E J[1], Meidl, V[1], Busch, A[2], Leonhart, R[3], Hirschmüller, A[4]

Impact of the COVID-19 pandemic on German Paralympic athletes

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2. UNIVERSITÄTSKLINIKUM FREIBURG, *Klinik für Orthopädie und Unfallchirurgie, Freiburg; Universität Potsdam, Hochschulambulanz, Potsdam*
3. UNIVERSITÄT FREIBURG, *Institut für Psychologie, Freiburg*
4. UNIVERSITÄTSKLINIKUM FREIBURG, *Klinik für Orthopädie und Unfallchirurgie, Freiburg; Altius; Swiss Sportmed Center, Rheinfelden, Schweiz*

› **Background:** The COVID-19 pandemic is affecting health and well-being globally. For the first time in history the Olympic and Paralympic Games were postponed. The purpose of this study was to assess the impact of the COVID-19 pandemic on competitive para-athletes. We aimed to identify special aspects of disabled athletes during the pandemic, and their mental health.
› **Methods:** All candidate athletes preparing for the Tokyo Summer Paralympic Games (n=298) were asked to complete a COVID-19 questionnaire. The questionnaire was provided between May and July 2020 and consisted of 21 questions about sports participation, physical and mental health as well as the occupational and personal impact of the COVID-19 pandemic.
› **Results:** A total of 109 athletes (37%, 52 men, 57 women, mean age 29.2 (±10.4) years) agreed to participate and completed the questionnaire between May 17th and August 30th 2020. Only one of the 109 athletes stated having been tested positive on SARS-CoV2. 14 additional athletes (12.8%) stated having been tested negative. 70% of the athletes felt that organizing their training was very difficult or difficult since February 2020. Two-thirds of the athletes trained less than before. 22% of the athletes were in quarantine. Half of the participants worried about their own well- being, 25% about their career, only 8% about their finances. There were no statistically significant differences between team and individual athletes, the impairment groups or men and women concerning anxiety about the COVID-19 pandemic. Many athletes worried about the social impact of the COVID-19 pandemic and half of the respondents were of the opinion that people with disabilities are specially affected by the COVID-19 pandemic.
› **Conclusion:** The COVID-19 pandemic has a huge impact on sports of elite para- athletes. Two-thirds of the athletes found that organizing their training was difficult, two-thirds trained less than before. German paralympic athletes are concerned about their health and the socio-psychologic consequences of the pandemic. The COVID- 19 pandemic poses a special challenge for people with disabilities concerning participation in their private, occupational and sporting environment.

NR. 303 PS-24-006 COVID

Maier, P[1] Deibert, P[2]

Influence of covid-19 restrictions on physical activity of clinic workers

1. BEWEGUNGS- UND ARBEITSMEDIZIN
2. INSTITUT FÜR BEWEGUNGS- UND ARBEITSMEDIZIN

› **Background**: The measures to contain the spread of the coronavirus also have far-reaching restrictions with regard to leisure activities. In particular, the closure of gyms as well as the shutdown of club sports could have an impact on activity behavior. Initial results from activity surveys suggest that sporting activity in the population may have decreased as a result of the Corona pandemic. The Corona pandemic poses major challenges for health workers in particular. Thus, the extent to which recreational activity behavior will be affected by pandemic containment measures is unclear.
› **Methods**: A retrospective cross-sectional survey was conducted to assess the activity behavior of healthcare workers before and during the restrictions against the coronavirus using an online version of the Freiburg Activity Questionnaire. The activity level for basic, leisure and sports activity were recorded in minutes per week. Using a Wilcoxon test with connected samples and a significance level of p < ,05 the activity behavior was examined for differences for before as well as during the pandemic restrictions in March 2020.
› **Results**: N = 735 employees of the University Hospital Freiburg (26,9% male, 72,7% female and 0,1% diverse) participated in the survey. A significant difference could be measured between the sports activities per week before (M = 240,3 min.; SD = 221,8 min.; Median = 180,0 min.) and during (M = 184,4 min.; SD = 206,4 min.; Median = 120,0 min.) the restrictions. Before the restrictions, 57,8% of the respondents achieved the activity levels of at least 150 min/week recommended by the WHO. This value dropped to 43,8% during the pandemic measures. In contrast, the proportion of inactive persons increased from 17,2% to 31,6%.
› **Conclusion**: The measures to limit the spread of the coronavirus have led to a reduction in activity behavior. In particular, fewer clinic employees are doing sports. This could be related to the closure of gyms, as corresponding activities have been particularly reduced. Further surveys should take into account the perceived workload and measure the associated stress as well as physical complaints. The survey could also be extended to other institutions outside the health sector.

NR. 304 OP-13-005 COVID UND KLIMA

Bauer, P[1] Kraushaar, L[2], Dörr, O[3], Keranov, S[3], Nef, H[3], Hamm, C[3], Most, A[3]

Vascular alterations among male elite athletes recovering from SARS-CoV-2 infection

1. JUSTUS- LIEBIG UNIVERSITÄT GIESSEN
2. ADIPHEA GMBH
3. JUSTUS- LIEBIG UNIVERSITÄT GIESSEN

› **Aims**: SARS-CoV-2 may affect the cardiovascular system and vascular impairment has been reported in healthy young adults recovering from COVID-19. However, the impact of SARS- CoV-2 infection on the vascular function of elite athletes is unknown.
› **Methods and Results**: We examined 30 healthy male elite athletes (age 25.8±4.6y) pre-season and at a 6-month follow-up (182±10d). Cardiac assessment included ECG and echocardiography. Vascular function and central blood pressure (BP) were calculated using transfer function-based analysis of peripheral arterial waveforms obtained by oscillometry. Changes in cardiovascular parameters of SARS-CoV-2- infected athletes were compared with those who where not infected. Of 30 athletes, 15 tested positive for SARS-CoV-2 after the first examination and prior to the follow-up. None had severe COVID-19 or reported any persisting symptoms. At follow-up, athletes who had COVID-19 displayed a significant increase in heart rate (59.3±8.6 vs. 54.8±8.8 mmHg, p=0.0038) and augmentation index@75 (-20.5±8.2 vs. - 26±8.2%, p=0.002) and a decrease in pulse pressure (61.4±13.1 vs. 64.1±11mmHg, p=0.038) compared with baseline. In contrast, uninfected athletes showed a significant increase in central systolic (102.5±4.7 vs. 98.6±5mmHg, p=0.002) and diastolic BP (64.8±7.2 vs. 59.2±8.4mmHg, p=0.030). Further, an increase in mean brachial BP was observed in both groups (SARS-CoV- 2: 84.3±7.1 vs. 77.6±6.5mmHg, p=0.011; controls:81.7±4.7 vs. 75.3±6.1mmHg, p=0.004).
› **Conclusion**: Significant vascular alterations in male elite athletes recovering from COVID-19 were observed that suggest vascular impairment and, thus, may affect athletic performance. This finding should be further evaluated in future studies.

NR. 305 OP-13-006 COVID UND KLIMA

Forde, C[1] Wyse, J[1], Barrett, E[1]

As restrictions continued - Changes in physical activity during COVID-19 restrictions in Ireland across two time points.

1. TRINITY COLLEGE DUBLIN

- **Background**: Living during a global pandemic resulted in many changes and challenges to our lifestyles. People were required to make changes to facilitate new work habits, commuting practices and caregiving duties, all of which had the potential to impact on their time, ability and motivation to be physically active. The aim of this research was to investigate physical activity levels and the associated barriers and facilitators to physical activity in the Irish population during COVID-19 restrictions.
- **Methods**: Data were collected from adult members of the general population by means of two anonymous online surveys distributed by social media. The first survey was carried out during nationwide restrictions in May 2020 and the second during restrictions in November 2020.
- **Results**: Both surveys had over 1000 respondents. In May, 54% of respondents were meeting the physical activity guidelines of thirty minutes of moderate intensity physical activity on five days of the week, decreasing significantly to 42% (X2 p <0.01) in November. Almost half of people reported being more active than usual in May, decreasing to a quarter in November. The percentage of people who reported being less active than usual increased from 28% in May to 35% in November. Almost all participants reported being active to benefit their physical and mental health. The proportion of people reporting barriers to physical activity increased from May to November. The main barrier reported by almost half of participants in both surveys was their usual means of exercise being unavailable. Increasingly, respondents felt that being unable to meet their friends (May 20%; November 32%) and working more than usual (May 20%; November 30%) limited their ability to be physically active between the two timepoints.
- **Conclusion**: The initial positive trend in physical activity engagement by the Irish public during COVID-19 restrictions was not maintained during the second period of restrictions. Additionally, one in three people were less active than usual at both time points. Exploring alternate means of accessing physical activity, providing advice about incorporating activity into busy work schedules and activities that prioritize the social and motivational benefits of exercising with others may need targeted action.