



**Exercise
Science
Reviewed**



Symposium



Clinical
Exercise
Science

February 20th 2015

Content

Introduction & Keynote lecture14:00 – 14:35

Introduction

Prof. Dr. Frank Mayer.....14:00

Biomechanical and neuromuscular effects of extensive running on the musculoskeletal system

Dr. Heiner Baur.....14:05

Student Presentations Part I: Exercise Physiology..... 14:45 – 15:45

1. The impact of antioxidants on exercise-induced cell damage - a systematic review

Nina Beutler.....14:45

2. Effects on VO₂peak of high intensity interval training compared to moderate intensity continuous training in patients after myocardial infarction

Sarah Niedrich.....15:00

3. Heart rate variability applied for the prevention of non-functional overreaching

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4. The effects of oral contraceptives on the aerobic performance in female athletes- a systematic review

Mares-Elaine Strempler.....15:30

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Student Presentations Part II: Exercise Therapy & Orthopedic Pathologies..... 16:00 – 17:00

- 5. Exercise therapy effect for lumbar disc herniation on pain – a systematic review
Anne Schomöller.....16:00
- 6. Early sport specialization and injury risks in young athletes
Miralem Hadzic.....16:15
- 7. Effectiveness of Pilates in treating chronic low back pain
Saad Rauf.....16:30
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Student Presentations Part III: Exercise & Health.....17:15 – 18:00

- 9. Effects of exercise intervention on quality of life in post-surgical lung cancer patients– a systematic review
Corinna Henke.....17:15
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Aisha Shafqat.....17:45

Acknowledgements

Aim of the Program

The main focus of the Masters and Ph.D. program is the acquisition of research based and occupational skills for professions in the field of exercise, prevention and rehabilitation. The program is divided into clinical applications for patients as well as for recreational and high-performance athletes. Emphasis is put on a theoretical, methodological and experimental academic education.

The scientific curriculum encompasses the effects of physical activity in disease prevention and rehabilitation, with the focus on exercise physiology and physical therapy. The practical education entails collaborations with hospitals, in- and out-patient rehabilitation clinics as well as with the regional Olympic Sports Centre and the University where medical care is provided for athletes and students.

Participants will learn the skills required for leading positions in health services and academic careers. The aim of the Masters program is to develop an interdisciplinary approach to practical and scientific collaboration between various health science professions. The aim of the Ph.D. program is to acquire the skills necessary for independent research and academic teaching.



**Exercise
Physiology**

Part One

The impact of antioxidants on exercise-induced cell damage - A Systematic Review

Beutler N., Braun M., Mayer F.

Introduction

During exercise the level of reactive oxygen species (ROS)-production in skeletal muscle increases significantly. This is associated with elevated muscle damage and impaired muscle function. The supplementation with antioxidants may attenuate the oxidative stress and help to prevent the inflammatory response. The aim of this review is to assess whether supplementation with antioxidants decrease exercise-induced cell damage.

Methods

A literature search in MEDLINE and ISI Web of Knowledge was conducted with a restriction on language (English) and publication date (last five years). From the resulting articles only RCTs were included which used antioxidant supplementation (Vitamin E, Vitamin C, carotenes and flavones) and dealt with human subjects aged between 18 to 40 years. In addition, only trials were included satisfying every item of the PEDro scale.

Results

A total of 112 studies were identified out of which 12 met all inclusion criteria. All studies combined oral supplementation of antioxidants with physical activity. Blood samples were taken in all trials before and after exercise to measure the oxidative stress and the level of different biomarkers for cell damage. The time of exercise-intervention and supplementation varies between 2 and 16 weeks. After exercise, the oxidative stress markers were increased in all trials. All in all 5 of the trials did not find any effect of supplementation, 2 detected a decrease of oxidative stress and 5 trials found a reduction of muscle damage.

Conclusion

The present trials let assume that antioxidant supplementation contribute to attenuation of exercise-induced oxidative stress. Due to the lack of accordance and the great variation of the subjects' athletic background no definite statement can be made about antioxidant supplementation influences cell damage.

Keywords: Oxidative stress, physical activity, muscle damage, vitamin C, vitamin E, carotenoids

Effects on VO₂peak of high intensity interval training compared to moderate intensity continuous training in patients after myocardial infarction

Niedrich S., Moser O., Mayer F.

Introduction

Cardiac rehabilitation can reduce heart-related mortality by 26% in 2-5 years after the cardiac event. Exercise capacity (VO₂peak) strongly predicts survival, which leads to the correlation between the level of physical fitness and the occurrence of coronary artery disease manifestation. However, there is still uncertainty regarding the most effective way to organize the exercise training after myocardial infarction (MI). Therefore, we compared the effects of high intensity interval training (HIIT) versus moderate intensity continuous training (MICT) in patients after MI. Whereby studies investigating high intensity training (HIT) were also involved. As a hypothesis we expect that HIIT/HIT is more effective than MICT in patients after myocardial infarction.

Methods

Our research was done in Pubmed with no defined time span, using myocardial infarction and related terms for training as keywords (myocardial infarction and exercise; myocardial infarction and training). We included studies involving patients aged > 18, females and male, with or without surgery. The study was excluded when it was no randomized controlled trial

Results

After screening by abstract we included 33 studies out of 254. Out of these we included 9 that matched the inclusion criteria and where full text article assessment was possible.

The primary outcome measure found in each study is peak oxygen uptake, which increased significantly in both training groups. Finally the HIIT/HIT group achieved a significant higher improvement compared to MICT group ($p < 0,05$).

Conclusion

HIIT/HIT is more effective in increasing VO₂peak in patients with MI than usual care rehabilitation. Therefore, it could be a time-efficient supplement or alternative for today's standard in cardiac rehabilitation.

Key words: myocardial infarction, training, exercise, VO₂peak

Heart rate variability applied for the prevention of non-functional overreaching

Pérez C., Moser O., Mayer F.

Introduction

Although several studies have examined the response of the autonomic nervous system (ANS) in athletes by measuring heart rate variability (HRV), the effectivity of this method to prevent non-functional over reaching (NFOR) in athletes is unclear. We hypothesized; that changes in athletes ANS suspected of having NFOR measured through HRV is not appropriate to prevent recovery of NFOR.

Methods

An electronic network search in PubMed, Science direct and Ovid was done. A total of 386 studies were found, and 22 met the inclusion criteria. Five studies were review articles, one article used HRV like a cognitive response, three papers used a different analysis of the HRV and one article was not able to achieve. After exclusion of these studies, 12 remained.

Results

We extracted data of the square root of the mean squared successive differences between adjacent RR intervals (rMSSD ms), low frequency (LF ms²), high frequency (HF ms²) and LF/HF index from five of the studies. All measurements were made before and after overload training protocol or a regular training-competition period. We normalized the data and took baseline measurements as reference (100%) and then calculated the changes for each variable. rMSSD decrease by 21 + 9.9% ($p < 0.05$); whereas an increase of -12.64 + 15.9% was found ($p > 0.05$). A decrease in LF by 20.8 + 24% ($p > 0.05$) was found, but there was also an increase of -33.9 + 39.3% ($p > 0.05$). The HF had a decrease by 35 + 24.2% ($p > 0.05$). Finally an increase of -74.9 + 49.6% for the LF/HF index was seen ($p > 0.05$).

Conclusion

The use of HRV can determine changes in the ANS of NFOR athletes, with out distinctive HRV pattern.

Key words: Non-functional over reaching, prevention, heart rate variability, athletes.

The effects of oral contraceptives on the aerobic performance in female athletes- a systematic review

Strempler M.-E., Kotsch P., Mayer F.

Introduction

Oral contraceptive (OC) use is quite common in female athletes as it reduces the disturbances related to the menstrual cycle. Nevertheless some athletes and coaches fear that OC use or the OC cycle might negatively affect the aerobic performance of the athletes. The purpose of this review is to determine if their concerns are reasonable.

Methods

A systematic literature search was conducted until December 6th 2014 in the scientific databases PubMed and ISI Web of Science using a key word search, limited to articles in English of the last decade. Only original papers dealing with female athletes or recreationally active women were included who examined either the effect of (1) the use of OCs or of (2) the different phases of the OC cycle on determinants of the aerobic performance.

Results

The initial database search resulted in 231 articles. Seven articles finally met all inclusion criteria. Two articles examined (1), three (2) and two assessed both. The included studies were case series (n=3), small cohort studies (n=3) and a cross-sectional study (n=1). Two studies found a significant reduction of the VO_2 peak in OC users ($p < 0,05$), one detected significant differences in blood lactate within the OC cycle ($p < 0,05$). Yet, in all included studies neither the OC use nor the OC cycle had a significant effect on the aerobic performance in athletes ($p > 0,05$).

Conclusion

Consistent with most previous investigations, recent studies demonstrated that there is no effect of OCs on the aerobic performance in female athletes. Thus athletes and coaches must not worry about OC use affecting the athlete's performance. However further research is recommended to substantiate the findings with more valid evidence.

Key words: oral contraceptives, endurance, aerobic capacity, athlete



**Exercise Therapy
&
Orthopedic
Pathologies**

Part Two

Exercise therapy effect for lumbar disc herniation on pain – a systematic review

Schomöller A., Müller S., Mayer F.

Introduction

Low back and leg pain are widespread symptoms that are frequently due to lumbar disc herniation. Instead or besides the standard approach of surgery exercise therapy is often applied. The purpose of this systematic literature review is to investigate the effects of exercises for lumbar disc herniation on pain.

Methods

The literature search was conducted in PubMed and Web of Science up to the 3rd of December 2014. Original articles in German or English language published within the last 5 years were included. Inclusion criteria were non-athletic adults with disc herniation, exercise intervention and valid pain measurement.

Results

From the initially identified 252 papers 9 papers (n=7 RCT, n=1 CCT, n=1 cohort study) met all inclusion criteria.

The comparison of surgical treatment and exercise intervention showed that both interventions decrease pain, but no significant difference was found between the two interventions ($p < 0.05$).

In 6 studies exercise intervention led to a significant pain reduction comparing pre- and post-measurements ($p < 0.05$). Out of those studies, 2 trials found no significant difference between intervention and control group and 1 study found a significant difference (greater pain reduction in intervention group, $p < 0.05$). 1 trial detected that exercise therapy had to be applied at least twice a week to have a significant positive effect on pain (comparing pre- and post-assessments, $p < 0.05$).

Conclusion

Exercise therapy is usually applied as treatment after surgery for lumbar disc herniation rather than as primary intervention. It has a positive effect on pain and thus represents an effective treatment. However, there is a lack of knowledge concerning the type of exercise which is most effective. No meaningful conclusion revealed for exercise therapy as primary intervention.

Keywords: disc herniation, exercise therapy, pain

Early sport specialization and injury risks in young athletes

Hadzic M., Müller S., Mayer F.

Introduction

There are two ways described to reach peak performance in elite sports which are discussed controversially. On the one hand early specialization is focused on early intense training in main sport while nearly excluding all other sports. The early diversification, on the other side, involves samplings of different sport experience in the childhood and specializes later during the adolescence. Both ways offer the possibility to become an elite performance athlete but have also disadvantage (e.g. injuries).

The purpose of this work is to identify if there is an association between early sport specialization and injury risks.

Methods

A literature search in PubMed, ISI Web of Knowledge and Mendeley was conducted, by using the following keywords in different combinations :“early sport specialization”, “injury risk “, “injury prevalence”, “injury incidence”, “young athletes”, “childhood”, “adolescence”, “late sport specialization”, “diversification”. Inclusion criteria of the studies are English language, publication date (last five years) and dealing with physiological injuries and sport specialization of young athletes.

Results

Three studies (n=1881 participants) were included in this systematic review. All were prospective studies and the participants were aged from 7 to 18 years.

The results show a significant relationship between the quantity of injured tennis players and early specialization in main sport ($p < 0.05$; OR 1.55). The athletes exercising year-round (> 8 month), choosing a main sport and excluding all other sports were more frequently injured compared to the non-specialized. Additionally injured athletes were older than uninjured.

Conclusion

From the reviewed articles it can be reasoned, that the early specialization may be a risk for being more frequently injured during the adolescence. Furthermore the injury risk seems to increase during the career and male athletes are at a higher risk. Athletes specializing in only tennis are more likely to have injuries.

Keywords: early sport specialization, early diversification, injury risk, young athletes

Effectiveness of Pilates in treating chronic low back pain

Rauf S., Intziegianni K., Mayer F.

Introduction

Global Burden of the Disease Study data showed that chronic low back pain (CLBP) is one of the 4 most common health conditions. It's a major cause of functional disability and absences from work. There are many schools of thoughts for treating CLBP. Pilates is one of the methods used to treat CLBP. However, there is a controversy in literature regarding its effectiveness. Therefore the purpose of this review is to examine the effects of Pilates exercise on CLBP based on the results given in the literature

Methods

A literature search was performed in the databases of PubMed Web of science and Science direct using key words "Pilates and low back pain", "Pilates and chronic low back pain", "Pilates exercise and low back pain". The search resulted in a total number of 578 articles. After careful screening of titles and abstracts, 9 Randomized Control Trails were included in the present review. The selected articles were reviewed in detail for the effectiveness of Pilates in treating CLBP.

Results

Studies have shown that Pilates has a positive effect on CLBP for 6-12 months as compared to other exercise protocols. Some studies suggest that effects of Pilates last up to 6 months and it is as effective as any other exercise protocol. On the contrary, one study suggested that Pilates has no effect on CLBP as compared to other exercise protocol.

Conclusion

Pilates is an effective method to treat CLBP, It's non-invasive and highly compliant. The short term benefit of Pilates on CLBP is evident from many studies but the long term effects are still unclear. Further research is needed to investigate the long term effects of Pilates on CLBP management.

Key words: Pilates, Low back pain, Exercise, Core stability

Effectiveness of exercise therapy in the treatment of patellofemoral pain syndrome

Rönnert F., Müller S., Mayer F.

Introduction

Patellofemoral pain syndrome is a common musculoskeletal injury among adolescents and young adults with a higher prevalence in females. Due to the fact that functional disorders and impaired muscular control are discussed as possible causes in the pathogenesis of PFPS this systematic review was accomplished to summarize the effectiveness of exercise therapy in reducing pain in female patients with PFPS.

Method

The literature search of PubMed and Web of Science databases was conducted to identify all randomized and clinical controlled trials of the last 5 years (2010-2014) in English language focusing on exercise therapy in patients with PFPS. Trials with other diagnoses and no available full text papers were excluded. Only studies with female participants were included in this review. Considered outcome measure was self-reported pain.

Results

From 101 publications 6 randomized controlled trials were identified. Exercise therapy consisted either of strength training, stretching or functional stabilization training or in combination. In contrast to baseline measurements all exercise groups experienced improvements in pain after intervention. Four studies compared the effect of quadriceps exercise alone versus quadriceps with additional hip exercise. Two of these studies with combined treatment reported significant reduction of pain ($p < 0.05$). One study examined hip strengthening with a control group not receiving exercise. Significantly greater pain reduction ($p < 0.05$) was found in the exercise group and did not alter in the control group. One study showed significant reduction of pain ($p < 0.05$) in hip- compared to quadriceps-strengthening after 4 weeks.

Conclusion

All studies showed that exercise therapy has positive effects on pain intensity. There is strong evidence that a combination of hip- and knee- strengthening exercise was more beneficial than to a program of quadriceps strengthening exercise alone. However consensus has not been reached so far which type and intensities of exercise are most effective.

Keywords: patellofemoral pain syndrome, females, exercise therapy, VAS, NPRS



**Exercise
&
Health**

Part Three

Effects of exercise intervention on quality of life in post-surgical lung cancer patients – a systematic review

Henke C., Kotsch P., Mayer F.

Introduction

After surgery the patient's activity level is often tremendously limited leading to a diminished quality of life (QoL). This review evaluates the effects of an exercise intervention on QoL in post-surgical lung cancer patients, which might break the vicious circle created through the connection of physical inactivity and the worsening of symptoms and side effects.

Methods

The following electronic databases were searched systematically until December 2014: PubMed, Web of Science, and PEDro. References of relevant clinical trials and systematic reviews were also hand-searched. Results were limited to the past seven years. Only randomized controlled trials (RCTs) evaluating the effect of an exercise intervention on QoL in post-surgical lung cancer patients were included. Full-text versions of all relevant articles were selected and evaluated by the author. Eligible studies were identified, and methodological quality was assessed with the Physiotherapy Evidence Database scale (PEDRO).

Results

Six articles were included in this review. In five studies including light to moderate exercise training no between-group differences were observed concerning QoL. However, two studies reported positive trends in some QoL domains. One study including high-intensity strength and endurance training demonstrated significant effects on QoL in favor of the intervention group ($p \leq 0.05$). Exercise interventions, QoL questionnaires used and follow-up times differed considerably impeding comparison.

Conclusion

No firm conclusions can be drawn because of the heterogeneity of the studies included in this systematic review. The different findings may be explained by the longer intervention period and higher exercise intensity in the study recording significant improvements. With regard to our results further high quality RCTs are needed to test the effect of high-intensity exercise interventions on QoL in surgically treated lung cancer patients.

Key words: lung cancer, exercise, surgery, quality of life

Resistance Training influences fatigue in Multiple Sclerosis patients

Eckstein M., Rüssmann A., Mayer F.

Introduction

Patients suffering from the demyelinating chronic disease Multiple Sclerosis, report fatigue and muscle weakness as their main burden. Light resistance training is the most common used option to treat these complaints. Yet, the increase of maximum strength is the goal in lifting weights; we considered that heavy strength training is an also feasible intervention to treat fatigue in MS-patients.

Methods

A comprehensive literature research of databases (PubMed and ISI web of knowledge) beginning at 1st of January 2004 until the 2nd of December, 2014 was conducted. Only studies in English were applied. Multiple Sclerosis was defined by EDSS scale and fatigue as it is multifactorial by MFIS/MFI-20. Resistance training was defined as heavy strength training by $85\% \leq 1RM$ and repetitions $n \leq 4$. All studies used for this systematic review were also rated by PEDro.

Results

No results have been found matching our search criteria. Only 1 study matched the criteria of heavy resistance training influencing MS. Overall there have only been 3 studies with applicable intervention criteria of light resistance training influencing measurable fatigue on MS patients. Results showed a significant decrease of MS-fatigue ($P \leq 0,05$) but not for self-reported EDSS scale ($P \leq 0,05$). Interventions differentiated by time (8-12 weeks) and by load (2-4 sets to 6-20 repetitions). Their PEDro rating was in mean 4 of 10 points.

Conclusion

There is no evidence regarding heavy resistance training influencing MS-fatigue. Lighter resistance training interventions show positive results by decreasing EDSS and MFIS under different setups. Heavy resistance trainings influence on MS was only investigated with different outcome measures but with significant results. This strongly recommends further investigation regarding its influence on EDSS and MFIS.

Keywords: EDSS, MFIS, MFI-20., Weight Training, PEDro

Effect of strength training vs aerobic exercise training on bone mineral density of postmenopausal women.

Shafqat A., Engel T., Mayer F.

Introduction

Postmenopausal women are at a higher risk of losing bone mineral density and hence getting prone to fractures. Many studies support the beneficial effect of Resistance Training(RT) in achieving a high Bone Mineral Density(BMD) while fewer have compared the role of aerobic exercise(AE) vs. RT. The objective of this study was to determine which of the previously mentioned exercise regimens has a better effect on BMD.

Methods

Literature search on PubMed was conducted for articles published within last 10 years limited to RCTs and systematic reviews focusing on the effects of RT or aerobic activities (or both) on BMD. Investigated participants must be post menopausal females. Initially, 3 searches were made and cited references in the retrieved articles were included in the result additionally.

Results

This systematic search strategy resulted in 59 hits. After reading their abstracts, 19 relevant articles were retrieved. After full text reading, results from 6 RCTs, 1 meta-analysis and 4 systematic reviews were included. 7 studies assessed the effect of RT on BMD, 5 assessed effect of impact AE while 2 studies looked for no or low impact AE. Overall results show that both RT and high impact AE have a beneficial effect in increasing BMD (0.51-1.28% for RT and 0.35-1.29% for impact AE). 2 studies showed no effect of low impact AE on BMD ($p>0.05$).

Conclusion

From the results, it can be concluded that both RT and impact AE have a positive role in increasing BMD in postmenopausal women. High impact AE are more effective than low-impact or non-impact AE in improving BMD.

Keywords: bone mineral density, resistance exercises, aerobic exercises, postmenopausal

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Sincerely,

The CES –students from the fifth cohort:

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**Thank
You**