Study about the results of the training programs

(WP4_D4.7)

I.M.Health

ERASMUS+ Sport

(Project No.: 101090407)

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Positive effects of a twelve week low-threshold exercise intervention on physical and mental health.

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ABSTRACT

In a sedentary society, exercise and physical activity are recommended to achieve and maintain a healthy lifestyle. Although this knowledge is widespread in society, individual commitment and motivation to exercise remains a key factor. Low-barrier and highly inviting exercise programmes are needed.

In this study, we tested the effects of twelve weeks of a comparatively new and unknown team game, Water Skyball, in combination with a proven balance training on physical and mental health parameters.

91 people from the general community aged 18-26 years were divided into three groups and received either Water Skyball only, Balance² Training only or a combination of both over a 12-week intervention period. A control group received no additional interventions.

The data show a clear improvement in both mental (WHO quality of life index) and physical health (cardiovascular fitness, flexibility, stability) in the intervention groups, with the greatest improvement when team play and individual BBalance² training were combined.

We conclude that a twelve-week intervention training with two training sessions per week seems to be sufficient to improve health. The combination of team sports and individual fitness training seems to be the most beneficial.

INTRODUCTION

The lifestyle of the 21st century does not satisfy the human need for physical activity, either qualitatively or quantitatively. Sedentary lifestyles, hours spent sitting at desks doing office work or in cars during the daily commute, looking at computer and other screen displays throughout the day - as proven by a number of studies - are all detrimental to health [1]. The widespread adoption of the 'home office' as an accepted working environment - as a result of the pandemic - also encourages a sedentary lifestyle [2].

People today are far removed from what could be considered "natural" in terms of adequate and regular physical activity or exercise. Furthermore, the current environment does not allow for the adequate amount of exercise that is both necessary and healthy for humans.

These changes in lifestyle are at the root of many individual and social problems. At an individual level, the consequences of a sedentary lifestyle include musculoskeletal problems.

At a societal level, the decline in individual health and well-being leads to an increased burden on the health care system, which in turn reduces the quality of the services it provides, and ultimately to a general decline in both work performance and quality as a result of the poorer general health of the population [3].

Although the problems caused by sedentary lifestyles have been recognised in the EU over the years and numerous directives have been created to address this issue, such as the Council Recommendation on Physical Activity and the European Union Work Plan for Sport, neither the general health of the population nor their attitudes towards physical activity show any improvement. One of the main reasons for this is that people are not aware of the impact that sport and other physical activities have on their health [4].

People also tend to believe that they are in adequate health because they don't experience any acute medical complaints and are therefore unaware of their actual fitness and possible medical conditions. It is only when more serious symptoms and conditions occur that they are

confronted with their actual lack of health and fitness and the adverse effects of their lifestyle on their health [5].

The Innovative Methods for Maintaining and Improving Health in the 21st Century (I.M.Health) project focuses on how people's needs for physical activity have changed and evolved due to lifestyle changes in the 21st century, and the development of innovative methods to meet these changing needs. Our aim is to understand how and to what extent sport and physical activity affect health, and to develop and apply methods that enable people to maximise the beneficial effects of sport and physical activity.

In this study, we aimed to investigate the effects of three different 12-week exercise intervention programmes (1) Water Skyball (WSB), (2) a specific balance programme (BAL) and (3) a combination of WSB and BAL on physical and mental health parameters compared to a non-exercising control group.

It was hypothesised that the combination of the two interventions, WSB and BAL, would have the greatest impact on cardiovascular function, flexibility and quality of life.

METHODS

The I.M.Health project is a project funded under the European Erasmus+ scheme. Its objective is to (1) raise awareness on the effects sports and exercise have on our health, (2) To expand the knowledge of sports and health professionals by gathering and analyzing fitness assessment methods that are being used today and (3) To develop and apply a new fitness assessment method that is specialized for the XXI. century sedentary lifestyle.

The project was carried out at three European sites: the Hungarian Water Skyball Federation in Szeged, the United World Games in Hollabrunn and the Institute Popotnik in Ljubljana.

For the intervention and control group, 91 previously sedentary university and high school students, aged 18-26 were recruited. These were randomized to one of three groups: a group

receiving Balance² exercise (BAL, two visits of 60 min/week), a group training water skyball (WSB, two visits of 60 min/week), a group receiving one Balance² class and one water skyball training per week and a control group receiving no exercise intervention. Physical and mental assessments are carried out at baseline and after twelve weeks of training. Six individuals decided not to finalize the program and were excluded from data analysis.

Exercise interventions

Balance² (BAL) is a movement therapy training method that focuses on the entire body. It aims to strengthen muscles weakened by sedentary lifestyle or injuries, as well as to increase flexibility and mobility in muscles. The classes are 55-60 minutes long, led by an instructor who demonstrates, explains, and corrects the proper execution of exercises. The classes consist of a 10-15 minutes long warm-up part, a 30-40 minutes long main part with coordination, balance and strengthening exercises, and 10-15 minutes long stretching part.

Water Skyball (WSB) is a non-contact aquatic ball sport played in waist-deep water. Moving in waist-deep water strengthens the core muscles of the players, while minimizes (together with the non-contact rule) the risk of injuries and the taxing on the joints and muscles. The 60 minutes long training sessions consist of a 5-10 minutes long warm-up part; a 40-50 part main part including practicing the movement (walking, running) in water, passing, shooting, tactics as well as playing the game 2 against 2; and 5-10 minutes long stretching part. The coaches leading the training sessions, and WSB sport in itself encourage participants to play in team, and try to use tactics, mental skills, so not just their physical strength.

Physical and mental assessments

Changes in cardiovascular activity caused by the twelve-week exercise intervention period were assessed by recording heart rate (bpm) before and after a three minutes step test. Stand and reach flexibility (distance of fingertips to the floor) and shoulder mobility (left/right) were assessed before and after the 12 weeks exercise intervention.

Changes in balance were assessed recording the time participants could remain a single leg stand right and left with closed eyes.

Assessing the time participants could remain a plank allowed to identify changes in core stability before and after the twelve-week exercise intervention period.

The World Health Organizations' quality of life questionnaire (WHOQOL) was used to identify perceived changes in the quality of life of the participants.

Statistics

Statistical analysis was performed using STATISTICA version 7.1 (StatSoft, Tulsa, USA). Comparisons of heart rate (bpm), stand and reach flexibility (cm), shoulder flexibility (l/r, cm), single leg stand (l/r, s) and time in plank (s) were performed using repeated measures ANOVA with the between-group factor "EXERCISE" (BAL^2, WSB, BAL^2+WSB, CON) and the within-group factor time (before/after 12 weeks). Where appropriate, Fisher's least significance difference test (LSD) was used for post hoc analyses. The level of significance was set at $p < 0.05$. Data are presented as mean +/- .95 confidence intervals.

Friedman's repeated measures analysis of variance (ANOVA) was used to statistically analyze changes in perceived quality of life (WHOQOL). Wilcoxon paired samples test was used as a post hoc test wherever a significant measurement effect was detected so as to determine the exact location of differences.

RESULTS

WHO – Quality of Life index

Across all interventions, self-rated QOL was significantly ($p < .05$) higher AFTER the intervention. Although no significant difference was observable ($p = .09$), QOL was slightly increased AFTER the interventions combining water skyball and Balance² (red) and water skyball only (green). No differences could be observed in the Balance² only group (blue) and in the CONTROL group (pink).

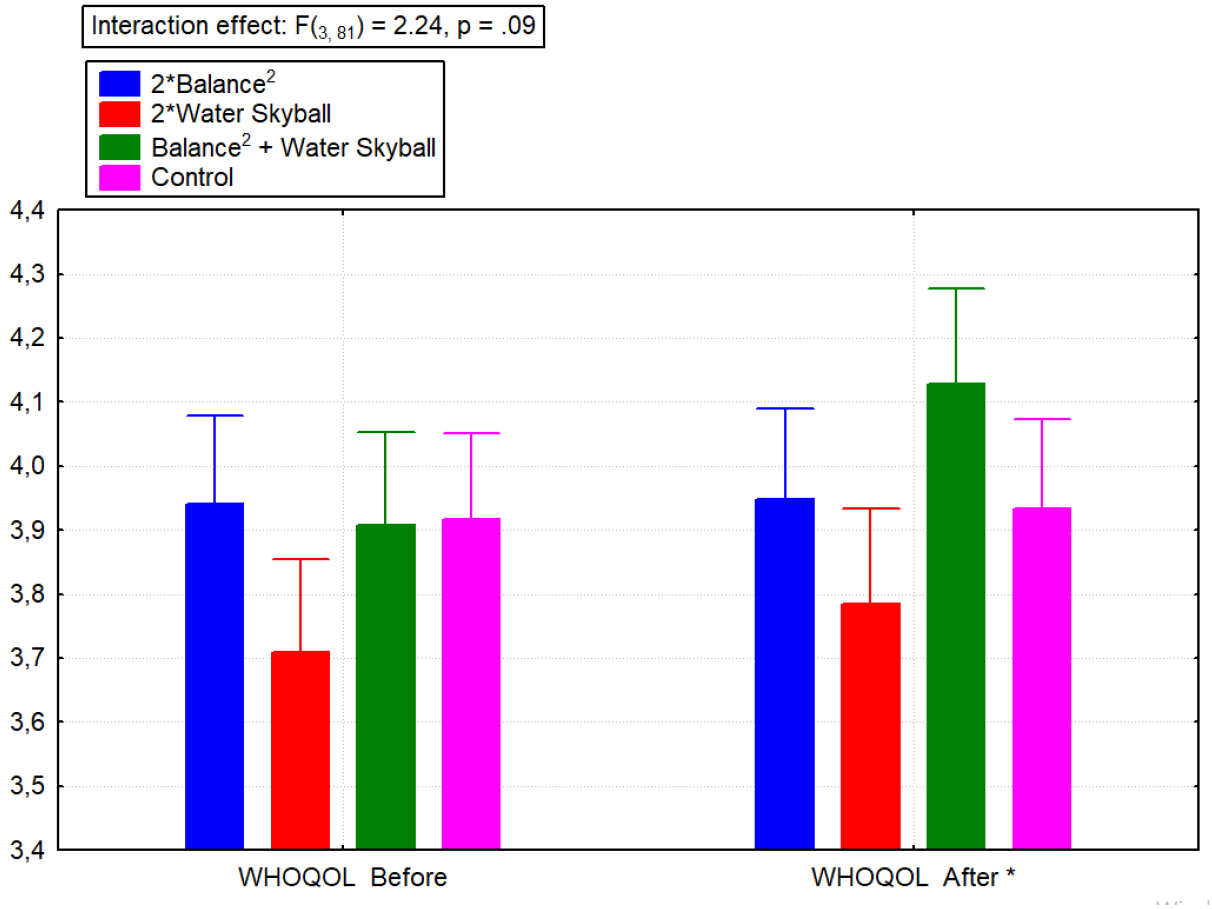

FIGURE 1: Differences Before / After intervention in the WHOQL questionnaire.

Changes in self-rated QOL across the intervention period of 12 weeks. *** indicates $p < .001$, * indicates $p < .05$ compared to the first assessment. Displayed are means +/- 95% confidence intervals.

Heart rate

Across all interventions heart rate was significantly ($p < .01$) lower AFTER the intervention. Post-hoc analysis on the interaction effect ($F_{(3,81)} = 6.23$; $p < .001$) revealed a significant decrease ($p < .001$) only after the combination of Balance² and water skyball training (green). A small but unsignificant decrease was observable in the groups receiving Balance² training (blue) and water skyball only training (red). No changes could be observed in the control group (pink, Figure 2A).

In contrast heart rate was not significantly lower AFTER the intervention ($p > .05$) but showed differences in between interventions ($F_{(3,81)} = 31.09$; $p < .001$). Post-hoc interaction analysis revealed a significant decrease ($p < .001$) in the group receiving water skyball and Balance² training (green) as well as in the group receiving only water skyball training (red). A small but unsignificant decrease was observable in the group receiving only Balance² training (blue). The CONTROL group (pink) showed a highly significant increase in HR after the three months period (Figure 2B).

Two minutes after the three-minute step test (Figure 2C) heart rate across all interventions was still significantly ($p < .001$) lower AFTER the twelve-week intervention ($F_{(3,81)} = 17,81$; $p < .001$). Post-hoc analysis revealed significant lower values in all three intervention groups (blue, red, green; $p < .01$) as well as an increase ($p < .001$) in the control group (pink).

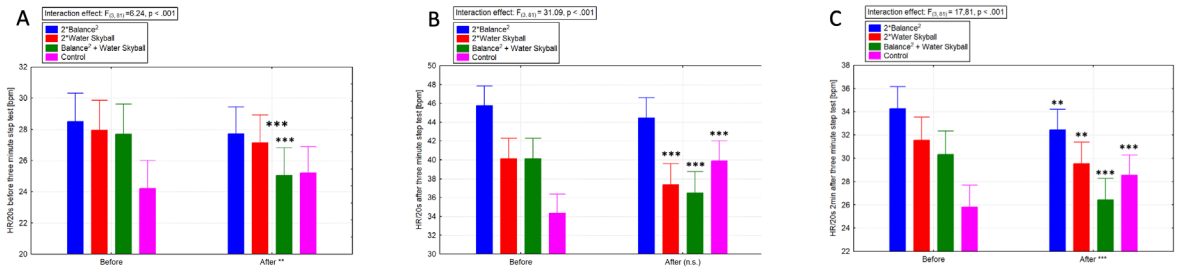

FIGURE 2: Differences in heart rate at the start / end / 2min post the three minute step test.

A: Changes in heart rate before and after the twelve-week intervention at the start of the three minute step test. B: Changes following the three minutes step test. C: changes two minutes past the three-minute step test. *** indicates $p < .001$, * indicates $p < .05$ compared to the first assessment. Displayed are means +/- 95% confidence intervals.

Flexibility

Stand and reach flexibility was significantly ($p < .001$) increased after the twelve-week intervention period. Post hoc analysis on the interaction effect ($F_{(3,81)} = 12.45$; $p < .001$) revealed a significant improvement ($p < .001$) for the two groups receiving Balance² training (blue) and Balance² plus water skyball (green) training. No changes were observed in the group receiving water skyball only (red) and in the control group (pink, Figure 3).

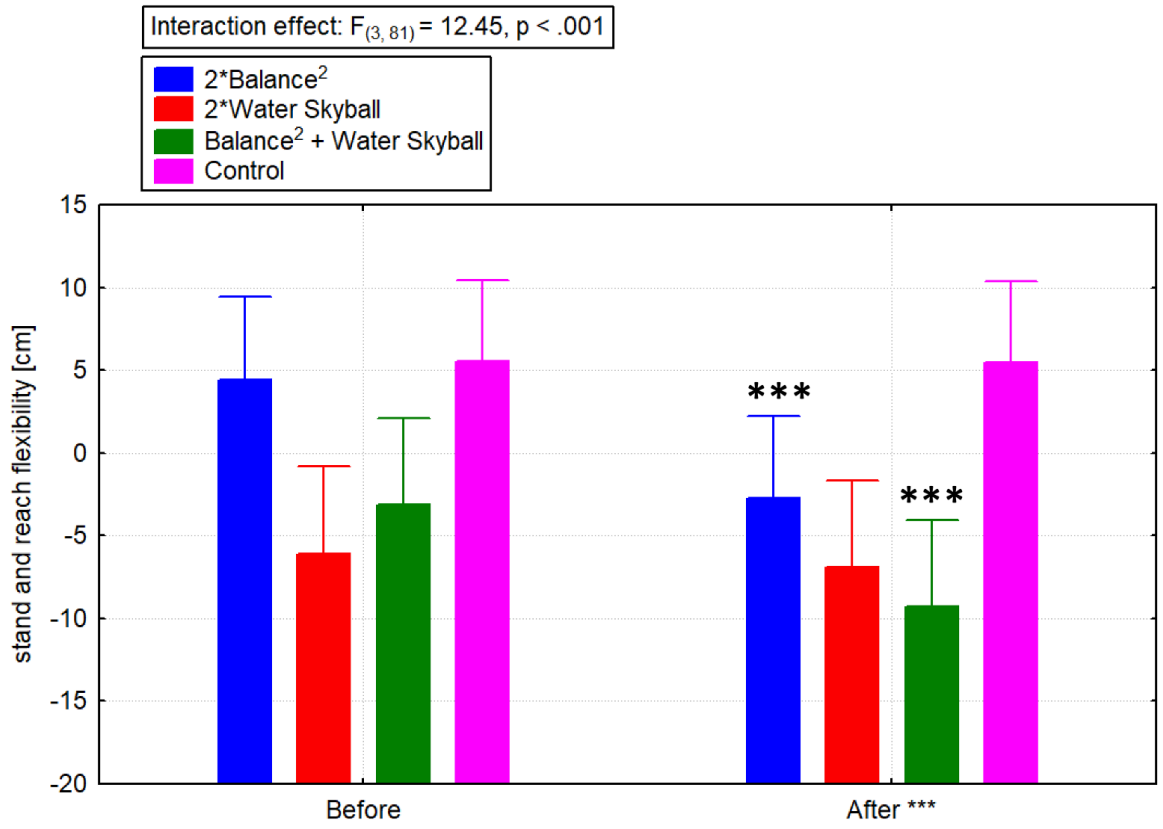

FIGURE 3: Differences Before / After intervention in stand and reach flexibility.

Changes in stand and reach flexibility (cm) across the intervention period of 12 weeks. *** indicates $p < .001$, * indicates $p < .05$ compared to the first assessment. Displayed are means +/- 95% confidence intervals.

Stability

Over all interventions single leg stand time on the right leg was significantly ($p < .05$) improved AFTER the intervention. No interaction between interventions was noticeable ($F_{(3,81)} = 1.55$; $p = .21$).

In contrast, single leg stand time on the left leg was significantly ($p < .001$) improved AFTER the intervention and revealed a significant interaction effect ($F_{(3,81)} = 5.96$; $p < .01$). Post-hoc analysis revealed a significant increase ($p < .001$) in the group receiving water skyball plus Balance² training (green). Slight but not significant increases could be obtained for the groups Balance² training only (blue) and water skyball training only (red), whereas the CONTROL group showed a slight decrease (Figure 4).

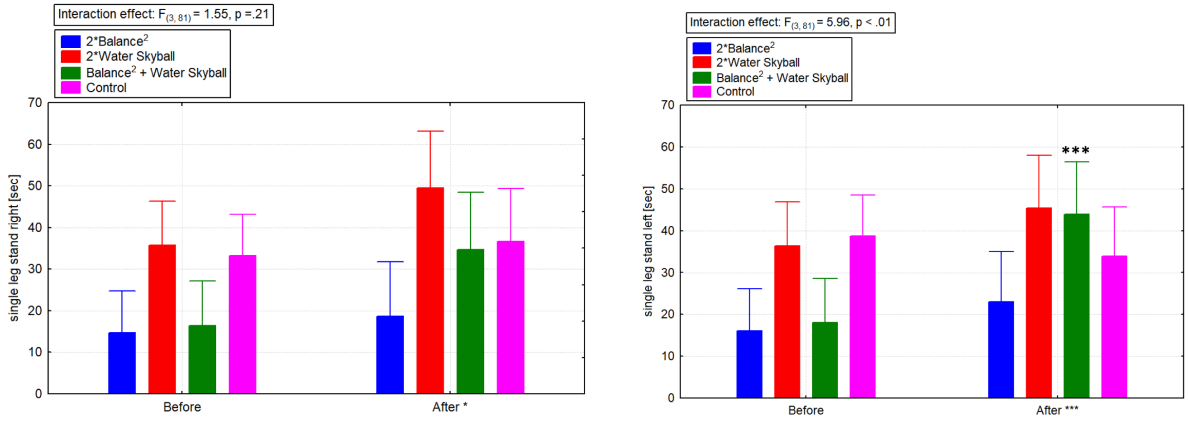

FIGURE 4: Differences Before / After intervention in single leg stand

Changes in single leg stand time (s) for the right (A) and left (B) leg across the intervention period of 12 weeks. *** indicates $p < .001$, * indicates $p < .05$ compared to the first assessment. Displayed are means +/- 95% confidence intervals.

Across all interventions time within the plank was significantly ($p < .05$) higher AFTER the intervention. Following interaction analysis ($F_{(3,81)} = 3.8$; $p < .01$) post-hoc analysis revealed a significant increase ($p < .001$) in the groups receiving Balance² training (blue) and Balance²

plus water skyball training (green). No differences could be obtained within the group receiving water skyball only training (red) and the control group (pink).

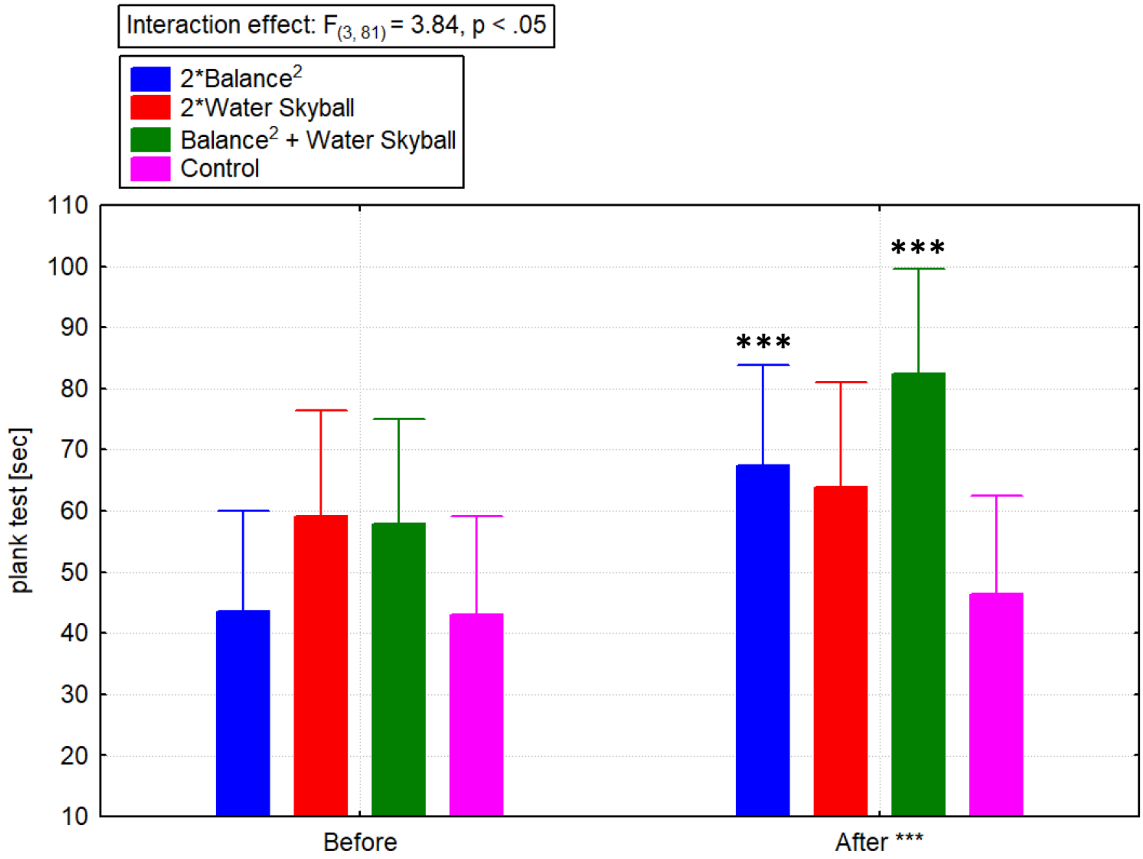

FIGURE 5: Differences Before / After intervention in the plank test.

Changes in plank time (s) across the intervention period of 12 weeks. *** indicates $p < .001$, * indicates $p < .05$ compared to the first assessment. Displayed are means +/- 95% confidence intervals.

DISCUSSION

This study aimed to determine the effects of three low-threshold exercise interventions on mental and physical well-being. Specifically, the effects of twelve weeks of Water Skyball / Water Skyball plus Balance² and Balance² alone exercise on WHO quality of life, cardiovascular adaptation, stability and flexibility were assessed in comparison to a group that received no intervention training over the aforementioned twelve-week period. It was

hypothesised that the combination of a team sport (Water Skyball) with strength and flexibility training (Balance²) would have the greatest effect.

The data showed a clear and positive effect on perceived quality of life as measured by the WHOQOL questionnaire. This effect was greatest after the Water Skyball plus Balance² intervention. A small effect was observed for the Water Skyball only group, whereas no changes were observed for the Balance² only group or the control group. This may indicate a positive effect of team sports on perceived quality of life.

As expected, the 12-week exercise intervention had a positive effect on the cardiovascular system, as indicated by a reduced heart rate before the three-minute step test after the 12-week intervention period (i.e. an overall decrease in resting heart rate), as well as a reduced heart rate after the three-minute step test. This was again strongest in the group that received Water Skyball plus Balance².

Flexibility and stability (plank test) were significantly improved in the two groups that received Balance² training either once or twice a week. This is not surprising, given that the aim of the Balance² exercise is to improve flexibility and stability, but it shows the effectiveness of this intervention.

When it comes to designing exercise interventions to optimise health, the data from this project successfully demonstrate that a multifaceted approach, combining the fun of a (water-based) exercise game with a dedicated strength and flexibility programme, appears to be highly effective. However, when designing health-oriented exercise interventions, it is important not only to consider the potential outcomes in terms of mental and physical health improvements, but also to focus on the motivation of participants to participate. The fact that regular physical activity has positive effects on mental and physical health is now well established through scientific research and there is sufficient evidence. Current health intervention programmes focus on how to motivate individuals to participate in exercise programmes. The most important key factor is probably a positive bias towards exercise. This bias can be derived from an

individual's bio-historical experience with a particular type of exercise and an individual preference for exercise intensity and duration [6]. Combined with low-threshold and fun offerings (e.g., water skyball), there is good reason to find ways to motivate people to exercise and contribute to their own health, as well as to reduce health economic costs.

SUMMARY

The combination of individual strength and flexibility training, combined with motivating and enjoyable team play, appears to be the most beneficial for improving mental and physical fitness through sport and exercise. This is in line with current recommendations from training and exercise science to use a greater variety of exercises to improve mental and physical health through exercise, rather than focusing on just one discipline.

LITERATURE

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