Author’s response to reviews

Title: Effects of a blocked versus an alternated sequence of balance and plyometric training on physical performance in youth soccer players

Authors:

Thomas Muehlbauer (thomas.muehlbauer@uni-due.de)
Vincent Wagner (WanTheMan@web.de)
Dennis Brueckner (dennis.brueckner@uni-due.de)
Simon Schedler (simon.schedler@uni-due.de)
Gerrit Schwiertz (g.schwiertz@hotmail.de)
Rainer Kiss (rainer.kiss@posteo.de)
Marco Hagen (marco.hagen@uni-due.de)

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Revised Manuscript [BMC Sports Science, Medicine and Rehabilitation - SSMR-D-19-00041 – Effects of a blocked versus an alternated sequence of balance and plyometric training on physical performance in youth soccer players]

Dear Dr. Jon Oliver, dear reviewers,

Thank you for your patience and your helpful comments regarding our manuscript. We included your comments in the revised version of our manuscript and hope that our manuscript is now suitable for publication in BMC Sports Science, Medicine and Rehabilitation.

Below you will find our point-by-point statements to the reviewers’ comments. Changes were highlighted in yellow for reviewer #1 and in green for reviewer #2.

Kind regards

The authors
Response to Reviewer #1: highlighted changes in yellow

Comment: The authors present an interesting paper examining the effects of short-term periodization of balance and plyometric training on physical performance in young football players. The findings are novel, the paper is well-written and the findings have both practical and scientific merit. There are a few areas where the paper could be enhanced further.

Statement: Thank you for your affirmative comment.

Comment: Introduction

In the introduction (and discussion) it is not clear why you are hypothesising that an alternated approach would be more beneficial than a blocked approach. I think it is important to give the reader some basis for your hypothesis.

Statement: Thank you for this valuable comment. We agree to add some information on why we assumed that an alternated sequence of balance and plyometric training would be more beneficial than a blocked arrangement. We added the following information to the Introduction section (page 6): “Hammami et al. [1] explained their findings by preconditioning effects of BT-related adaptations on subsequent adaptations induced by PT. However, it remains unclear and there is still a void in the literature on whether the positive effects of BT/PT training can be initiated early on using an alternating training sequence (i.e., weekly change of BT/PT) instead of a blocked one (i.e., several weeks of BT followed by several weeks of PT). In fact, there is evidence that preconditioning effects of BT-related adaptations on subsequent adaptations induced by PT are initiated early on and consequently, an alternating order might be more efficient compared to blocked schedule. On the one hand, Chaouachi et al. [2] showed significant improvements in physical performances of youth soccer players (age range: 13-14 years) when balance and plyometric exercises were combined within each training session. On the other hand, underlying mechanisms indicate that BT leads to (early) neuromuscular adaptations (e.g., improved activation of muscles encompassing the ankle joint) [3], representing a muscle group that is predominantly involved in proper jumping performance.”

Comment: Methods

I think it would be better to give the final sample size (of n = 17) here rather than leaving this until the results, as it creates a bit of an anti-climax. I think the methods can state the initial recruited sample and the final sample size to set the expectations for the reader early on.

Statement: We thank the reviewer for this comment, and have now moved this information from the Results section to the Method section as follows (cf. Participants, page 7): “All but one
player of the blocked BTPT group (due to common cold) received treatment conditions as initially allocated. No test-related injury was detected but two players (i.e., one of each group) reported a competition-related injury. Thus, performance data of 17 players (blocked BTPT: n=8, alternated BTPT: n=9) were used for the analyses.”

Comment: Statistical analysis.

I'm not sure why you have the univariate analysis for baseline comparisons. Post-hoc testing of your 2*2 ANOVA in SPSS would give you the baseline comparison (although in SPSS you do have to paste in extra commands to get all comparisons).

You refer to a Bonferroni correction. If all of your comparisons are 2*2 then there would be no corrections as there are never more than two means to compare (this can be confirmed from the SPSS output, as it will state if the Bonferroni correction has not been applied).

Statement: We thank the reviewer for these comments regarding our manuscript. We performed the comparison of pre-testing values to see whether there are possible baseline difference that have to be included as covariate in our statistical analyses. However, we did not detect significant differences in pre-test values between the two intervention groups.

You are right, all of our comparisons were 2 (Test: pre, post) × 2 (Group: blocked BTPT, alternated BTPT) ANOVAs with repeated measures on Test. Thus, the Bonferroni correction is not necessary and was indeed not applied. We excuse for mentioning this information in the initially submitted version of our manuscript, which we now excluded.

Comment: Results (and discussion)

I would be careful with the use of the term "significantly larger" when comparing blocked and alternating interventions. If responses to the two interventions are significantly different that would be reflected in a significant interaction effect. If the difference in responses was "larger" that would be reflected in an effect size that compares the effect of one intervention above the other intervention and shows a large (d > 0.8 effect). That may be the case but I think your effect size comparison are within-each group, rather than comparing the effect of block training over and above the effect of alternated training.

Statement: We agree with this comment because our post-hoc comparisons were within each group. Consequently, we adjusted the wording when related to our findings.

Comment: Discussion
There is no mention of maturity in your paper and this is relevant for the population examined. In not referring to maturity I think you underplay your findings. Based on your maturity offset you have a population in the middle of their growth spurt, a time when youth might experience adolescent awkwardness and when some injuries in soccer increase. I think showing that players in their growth spurt can respond to training is noteworthy.

Statement: We thank the reviewer for this comment and agree to include a statement that relates our results to the maturity status of our population. We added the following statement to the Discussion section (page 13f): “Further and based on the calculated maturity offset (Table 1), we investigated a population of trained individuals in the middle of their growth spurt. This is a time when youth might experience adolescent awkwardness [4] and when some injuries (e.g., soft tissue) in soccer increase [5]. Showing that players in their growth spurt can improve their physical performances in response to the applied training regimens is a noteworthy finding for coaches that are involved in training young athletes.”

Comment: Discussion

You include no limitations. An obvious limitation is the sample size, which will have influenced your statistical power and ability to detect significance. I think that should be acknowledged. It could be argued that effect sizes are more important, yet in your discussion and conclusion you never really refer to the often large effects that you observed. Instead you just focus on significance. Again, I think this imbalance partly underplays the importance of some of your findings.

Statement: Thank you for these valuable comments. According to your comments, we added a paragraph to the Discussion section stating the study limitation that reads as follows (page 15f): “Our study includes four limitations that need to be addressed. First, our sample size is relatively small, which will have influenced the statistical power and ability to detect significant effects. Second, our findings are limited to the examined age group (i.e., 13-year-olds). Therefore, we cannot comment on training-related adaptations to other groups of younger or older soccer players. Third, we did not include a control group. However, the inclusion of a passive control group (i.e., no training) would be difficult in an athletic setting as we cannot expect young, sub-elite soccer players to stop their training for six weeks. Also, the enclosure of an active control group (i.e., soccer training only) is hardly practicable, because balance and plyometric exercises are important components of the regular soccer training in youth players [6]. Thus, the observed improvements in physical performance are most likely the result of soccer-specific adaptations (including sprint, agility, and strength exercises) and alterations due to the applied balance and plyometric exercises. Fourth, the underlying mechanisms of the training-induced improvements in physical performance remain unclear as our methodological approach was limited to behavioral outcome measures.”
Further and according to your suggestion, we added information on the observed effect sizes to the Discussion section whenever suitable.

Response to Reviewer #2: highlighted changes in green

Comment: This study examined the acute effects of a blocked versus an alternated sequence of balance and plyometric exercises on physical performance in young soccer players. Physical qualities were compared and included variables of power, COD, speed and balance. The study reports two main findings: main effects for both protocols after 6 weeks of training and no superiority of one group in comparison to the other.

The study is well written in parts. The design is a replication of a previously not reported study (Chaouachi M et al. 2017. Within Session Sequence of Balance and Plyometric Exercises Does Not Affect Training Adaptations with Youth Soccer Athletes. J Sports Sci Med. 2017 Mar 1;16(1):125-136) but instead of using within session alternated sequence, authors change BT and PT on a weekly basis. The intervention time is short (6 weeks) and the number of players per group is limited (< 10 per group).

I do have suggested a few comments below to consider in improving the paper. I hope my remarks could be as critical as constructive for this and the future studies for this respectful group of researchers.

Statement: Thank you for your affirmative comment.

Comment: The introduction section does not provide a clear background of the potential application of week to week changes in the context of training periodization. This has not been clearly stated and backed up by supporting literature and associated evidences. Is that near from the real context of soccer conditioning.

This section is also lacking in describing the physiological and mechanical mechanisms associated to the proposed training mode, which could have a likely role in inducing long-term adaptations.

Statement: We agree with this comment, and Reviewer 1 additionally mentioned this point. Thus, we added further information explaining our assumption that an alternated sequence of balance and plyometric training would be more beneficial than a blocked arrangement to the Introduction section (highlighted in yellow [page 6] instead of green because Reviewer 1 additionally mentioned this point): “Hammami et al. [1] explained their findings by preconditioning effects of BT-related adaptations on subsequent adaptations induced by PT. However, it remains unclear and there is still a void in the literature on whether the positive
effects of BT/PT training can be initiated early on using an alternating training sequence (i.e., weekly change of BT/PT) instead of a blocked one (i.e., several weeks of BT followed by several weeks of PT). In fact, there is evidence that preconditioning effects of BT-related adaptations on subsequent adaptations induced by PT are initiated early on and consequently, an alternating order might be more efficient compared to blocked schedule. On the one hand, Chaouachi et al. [2] showed significant improvements in physical performances of youth soccer players (age range: 13-14 years) when balance and plyometric exercises were combined within each training session. On the other hand, underlying mechanisms indicate that BT leads to (early) neuromuscular adaptations (e.g., improved activation of muscles encompassing the ankle joint) [3], representing a muscle group that is predominantly involved in proper jumping performance.

Further, we conducted our study in between the first and second half of the soccer season (i.e., primary aim of the training regimen was to maintain performance). Consequently, an influence of training periodization (pre-season, in-season or off-season) was not part of our investigation. Further, the demands of balance and plyometric exercises are close to the real context of soccer conditioning and thus of major interest. This is supported by the fact that these kind of exercises are, for example, part of the FIFA 11+ Kids program to prevent injuries in youth soccer players [6].

With regard to your second issue (i.e., lacking in describing the physiological and mechanical mechanisms), we would like to refer you to our Discussion section (page 14f) where we provided information on possible mechanism from an behavioural and a neuromuscular level: “Hammami et al. [1] explained the BT-related adaptations on subsequent adaptations induced by plyometric exercises by a so-called “preconditioning effect”. On a behavioral level, BT leads to decreased body sway and increased postural stability while standing [7], representing a prerequisite for well-developed and trained jumping as well as landing performance. Further, BT has been shown to significantly improve postural control in various cohorts [8]. By this means, variations in the axial direction of ground reaction forces that may hamper jumping performance (i.e., potential misalignments of force vectors during jumping) can be reduced and the generation of force can be improved. On a neuromuscular level, BT results in an improved activation of muscles that encompass the ankle joint [3], representing muscle groups predominantly involved in proper and safe jumping performance.”

We prefer to keep this information in the Discussion rather than in the Introduction section, because we use these to explain and compare our findings with those of the current literature.

Comment: Methods section. Please add specific details about the time of the study during the season, the soccer training schedule and content, the testing plan and administration procedures.
Statement: Thank you for this valuable comment. We agree to add details about the time of the study during the season, the soccer training schedule, and content in the Method section (cf. Soccer, balance and plyometric training program, page 7) as follows: “The study was conducted between the first and second half of the soccer season. Both exercise groups conducted six weeks of soccer-specific training (four times a week) that included sprint, agility, and strength exercises as well as technical and tactical drills. The sessions were scheduled on Monday (115 minutes), Tuesday (100 minutes), Thursday (90 minutes), and Friday (80 minutes). In two of those sessions, the players either performed a blocked (Table 2) or an alternated (Table 3) BTPT program.”

With respect to the testing plan and the administration procedures, we provided specific details in the Method section (cf. Testing procedures, page 8) as follows: “Both, the pre- and post-testing was conducted in the afternoon (i.e., from 4 to 6 pm) using the same gym and by the same skilled assessors (graduated sport scientists). All players received standardized verbal instructions and a visual demonstration regarding the testing procedure that included assessment of anthropometric variables, dynamic balance (Y-Balance test), lower-extremity muscle power (squat [SJ], countermovement, and drop jump [DJ]), maximal speed (15-m sprint), and agility (figure-T run). This sequence of measurements was the same during the pre- and post-testings. Prior to each testing, all players conducted a standardized warm-up which consisted of balance exercises, submaximal plyometric exercises, short linear sprints, and change-of-direction sprints.”

Comment: Can we consider SJ height as a measure of power? How you are sure that there is no counter-movement without force curve?

Statement: We thank the reviewer for this comment. The squat jump is widely used as a measure of lower body power. The quality of the jump technique was controlled through visual on-site inspection of a skilled experimenter (graduated sport scientists). The term “skilled examiner” means that the person trained his competence of assessing squat, countermovement, and drop jump performance in a study course that included the testing of approx. 20 PE students before he was allowed to test the soccer players of the present study. To address the reviewer’s concern, we added the following statements to the Method section (cf. Testing procedures, page 9f): “The quality of the respective jump technique was controlled through visual on-site inspection of a skilled experimenter (graduated sport scientists).”

Comment: Training tables are similar. Consider using only one table.

Statement: We appreciate this comment. In terms of exercise (balance, plyometric) and values for repetitions and exercise duration, the tables 2 and 3 are similar. However, the specific order
(blocked or alternated) differed across the 6-weeks training duration. To highlight this difference, we prefer to keep both tables in its current form.

Comment: In the first paragraph of the discussion section, you reported three main findings. Discussion paragraph should follow this order. I don't think that safety and feasibility is a main finding. The authors reported also some tendencies towards significantly larger improvements in some parameters of balance and muscle power for the blocked compared to the alternated BTPT group as a main finding. But at the end the results were no significant, it was difficult to conclude any advantage for that method compared to the other as reported in P13. L16. It is possible only to argue the interest of both methods as they are equally effective. You have to modulate or qualify your assertions throughout the manuscript because the statistical were not significantly.

Statement: Thank you for these valuable comments. To address the reviewer’s concern, we deleted the first main finding on safety and feasibility. Further, our statistical analyses showed tendencies towards significant Test x Group interactions in some parameters of balance and muscle power. Post-hoc analyses yielded significant performance improvements from pre- to post-testing for the blocked BTPT. For the alternated BTPT, the improvements were smaller. Because, these findings were shown for some parameters of balance and muscle power, we concluded that there is a limited advantage for the blocked BTPT.

Besides statistical significance, the calculation of effect sizes is also important. As a result, we found larger effect sizes for the blocked (BALANCE: PL-ND: d = 1.34; CS-ND: d = 0.62; MUSCLE POWER: d = 0.63) as compared to the alternated (BALANCE: PL-ND: d = 0.22; CS-ND: d = 0.09; MUSCLE POWER: d = 0.09) BTPT. In other words, the differences observed for the combined BTPT have a higher practical meaning as for the alternated BTPT. Thus, we added information on the observed effect sizes to the Discussion section whenever suitable (highlighted in yellow instead of green because Reviewer 1 additionally mentioned this point).

Comment: As there is not control group in this study and no main group effect, the results improvements should be also discussed with regards to soccer specific training adaptations.

Statement: We agree with this comment, and Reviewer 1 mentioned to include statements on the limitations of our study. In the corresponding paragraph, we stated the lack of including a control group. As a consequence, both soccer-specific adaptations and adaptations due to the applied balance and plyometric exercises have to be mentioned. We included such statement at the end of the Discussion section (page 16): “[…] Also, the enclosure of an active control group (i.e., soccer training only) is hardly practicable, because balance and plyometric exercises are important components of the regular soccer training in youth players [6]. Thus, the observed
improvements in physical performance are most likely the result of soccer-specific adaptations (including sprint, agility, and strength exercises) and alterations due to the applied balance and plyometric exercises.”

Comment: To facilitate better insight into child–adult differences, the authors are urged to added to the discussion a section where measured effects in the present study would be compared with what has previously been found in other pediatric studies.

Statement: Thank you for this valuable comment. In the entire Discussion section, we compared our findings with those found in other pediatric studies. More specifically, we assessed 13-year-old boys and described studies in the first sub-section of the Discussion part (Combinatory effects of balance and plyometric training) that investigated adolescent boys with an age range from 12 to 15 years [9] and a mean age of ~16 years [10]. Further, in the second sub-section of the Discussion part (Sequencing effects of balance and plyometric training), we referred to a study that examined 12- to 13-year-olds [1]. At this point, we added a further study by Chaouachi et al. [2] that investigated the effects of different within session sequences of balance and plyometric exercises in youth soccer players (age range: 13-14 years). Using this procedure of discussion, we think that the current literature available on the present topic is sufficiently addressed.

Discussion section (page 14): “Further, Chaouachi et al. [2] investigated young male soccer players (age range: 13-14 years) that performed balance and plyometric exercises within each training session as alternating pairs or in a blocked fashion (balance before plyometrics). Following eight weeks of training (2 sessions per week), they observed that both groups significantly improved their balance, muscle strength/power, speed, and agility performances.”

References used for revision:


