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The association of technical and tactical performance indicators with the physiological responses of elite female netball players

Mullender, Christy

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June 20, 2018

Prof. Constantinou, Mr. Marc Booysen and Dr. Michele van Rooyen, HOD and Supervisors, Centre for Exercise Science and Sports Medicine

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Dear Prof. Constantinou, Mr. Marc Booysen and Dr. Michele van Rooyen,

Please find below corrections to my final dissertation requested by the examiners on the 30th May 2018.

1. Changed “P-value” to a small letter p throughout the paper
    a. Page ii – paragraph 4 – line 4
    b. Page 1 – paragraph 2 – line 14
    c. Page 6 – paragraph 3 – line 11
    d. Page 11 – paragraph 3 – line 3
    e. Page 12 – paragraph 1 – line 4
    f. Page 17 – paragraph 2 – line 6 and 8
    g. Page 17 – paragraph 3 – line 9
    h. Page 18 – paragraph 1 – line 1 and 4
    i. Page 18 – paragraph 2 – line 3
    j. Page 19 – paragraph 2 – line 13
    k. Page 26 – paragraph 2 – line 6 and 7
    l. Page 28 – paragraph 1 – line 5
    m. Page 28 – paragraph 2 – line 9
    n. Page 28 – paragraph 3 – line 8
    o. Page 29 – paragraph 1 – line 1
    p. Page 29 – paragraph 2 – line 7
    q. Page 31 – paragraph 1 – line 5 and 6
    r. Page 31– table 4.1 – line 2
    s. Page 32 – table 4.2 – line 2 and 4
    t. Page 32 – paragraph 1 – line 2
    u. Page 34 – paragraph 1 – line 4
    v. Page 36 – paragraph 1 – line 4 and 9
    w. Page 37 – paragraph 1 – line 3 and 5
    x. Page 37 – paragraph 2 – line 6
    y. Page 38 – Table 4.3 – line 1
    z. Page 38 – paragraph 2 – line 2
    aa. Page 39 – paragraph 1 – line 3
    bb. Page 41 – paragraph 1 – line 3 and 4
    cc. Page 43 – paragraph 1 – line 6 ad 7
    dd. Page 48 – paragraph 2 – line 5

2. Front Page
    a. Paragraph 3
    b. Line number 2
    c. Changed: “the degree of Master of Science in Medicine in the field of Sport and Exercise Science by dissertation” to “the degree of Master of Science in Medicine by Research”

3. Page ii - Abstract
    a. Paragraph 1
    b. Line 1 (heading)
    c. Inserted: Background

4. Page ii – Abstract
    a. Paragraph 1
    b. Line 2
    c. Deleted: HR
    d. Inserted: heart rates
    e. Deleted: may
    f. Inserted: can

5. Page ii - Abstract
    a. Paragraph 1
    b. Line 2
    c. Inserted: High physical exertion levels in athletes have been shown to influence technical performance negatively.

6. Page ii - Abstract
    a. Paragraph 2
    b. Line 1 (heading)
    c. Inserted: Aim

7. Page ii - Abstract
    a. Paragraph 2
    b. Line 2
    c. Deleted: Therefore,

8. Page ii - Abstract
    a. Paragraph 2
    b. Line 4
    c. Inserted (moved from methods paragraph below): The following objectives were addressed: 1) Record the duration of possession, number of passes and location of centre pass movements, 2) Compare heart rates of all the players involved in the movements which ended in points scored or possession lost 3) Compare the heart rate of the player, at the specific time the ball was released from when a goal was scored or a possession was lost.

9. Page ii - Abstract
    a. Paragraph 3
    b. Line 1 (heading)
    c. Inserted: Methods

10. Page ii - Abstract
    a. Paragraph 3
    b. Line 2
    c. Inserted: years

11. Page ii - Abstract
    a. Paragraph 3
    b. Line 7
    c. Inserted: the mean heart rates of all players involved in each attacking centre pass movement.

12. Page ii – Abstract
    a. Paragraph 4
    b. Line 1 (heading)
    c. Inserted: Results

13. Page ii – Abstract
    a. Paragraph 4
    b. Line 3
    c. Deleted: was on average comprised of 5.6 ±2.2 passes
    d. Inserted: displayed a median of 5 passes (IQR = 4-7) and p < 0.000 and

14. Page ii – Abstract
    a. Paragraph 4
    b. Line 3
    c. Deleted: The main findings of the study were that a successful centre pass movement was on average comprised of 5.6 ±2.2 passes and was 17.0 ±9.1s in duration, which was significantly different to unsuccessful centre pass movements (P < 0.001). The mean relative heart rate was 88.5 ±7.4 %HRmax for a successful centre pass however, this was not found to be significantly different from the relative maximal heart rates associated with unsuccessful centre passes (88.9 ±7.1 %HRmax, P > 0.05).
    d. Reworded: Successful centre pass movements displayed a median of 5 passes (IQR = 4-7) and were 17.0 ±9.1 seconds in duration, both significantly greater compared to unsuccessful centre pass movements (p < 0.000 and p < 0.001). The mean relative heart rate for successful centre passes was not significantly different from the mean relative heart rate for unsuccessful centre passes (88.5 ±7.4% versus 88.9 ±7.1%, p > 0.05).

15. Page ii – Abstract
    a. Paragraph 4
    b. Line number 3
    c. Changed 17 to 17.0

16. Page iii – Abstract
    a. Paragraph 1
    b. Line 1 (heading)
    c. Inserted: Conclusion

17. Page iii – Abstract
    a. Paragraph 1
    b. Line 4
    c. Inserted: ’

18. Page iii – Abstract
    a. Paragraph 2
    b. Line 5
    c. Deleted: relative
    d. Inserted: heart rate

19. Page v – Acknowledgement
    a. Paragraph 2
    b. Line 6
    c. Inserted: A big thank you to Mark Allen – the “Excel Guru” – for your expert advice when it came my data management.

20. Page 2 – Chapter One
    a. Paragraph 2
    b. Line number 1
    c. Removed: one of the words “are”

21. Page 2 – Chapter One
    a. Paragraph 3
    b. Line 4
    c. Inserted: elite

22. Page 2 – Chapter One
    a. Paragraph 3
    b. Line 5
    c. Inserted: Therefore, this study specifically investigated the physiological responses of players on court during their attacking centre passes.

23. Page 2 – Chapter One
    a. Paragraph 4
    b. Line 1
    c. Inserted: By recording heart rate responses of netball players during their attacking centre passes, this research study aimed to compare the physiological responses of centre pass movements which ended successfully in a goal to attacking centre passes where possession was lost. The researcher wanted to investigate if heart rate response played a role in the successful outcome of the team’s centre passes.

24. Page 2 – Chapter One
    a. Paragraph 5
    b. Line 1
    c. Inserted: which was carried out in a competitive-match setting
    d. Line 3
    e. Inserted: to assist coaches in making data-driven decisions.

25. Page 3 – Chapter One
    a. Paragraph 4
    b. Line 1: Hypothesis
    c. Original paragraph: Physiological parameters of netball players will have a significant association with technical and tactical performance indicators relating to movements from a centre pass which end in points scored or possession lost on court during competitive matches.
    d. Reworded: During competitive matches, there will be an association between centre pass movements and heart rates. In CP movements that end in possession lost, a higher mean heart rate for all players will be observed.

26. Page 3 – Chapter One
    a. Paragraph 5
    b. Line 1: Null hypothesis
    c. Original paragraph: Physiological responses of netball players will have no effect on technical and tactical performance indicators relating to movements from a centre pass which end in points scored or possession lost on court during competitive matches.
    d. Reworded: During competitive matches, there will not be an association between centre pass movement success and heart rates. Therefore, no difference in mean relative heart rates will be observed between CP movements that end in either a goal or possession lost.

27. Page 5 – Chapter Two
    a. Paragraph 1
    b. Line number 3
    c. Changed: “state” to “stated”

28. Page 6 – Chapter Two
    a. Paragraph 1
    b. Line number 4
    c. Deleted: full stop before the reference

29. Page 14 – Chapter Two
    a. Paragraph 1
    b. Line number 3 and 8
    c. Changed VO^2 to VO_2

30. Page 15 – Chapter Two
    a. Paragraph 2
    b. Line number 5
    c. Changed: “suggests” to “suggest”

31. Page 15 – Chapter Two
    a. Paragraph 5
    b. Line 1: Heading
    c. Changed “Fatigue” to “Physiological Responses to Exercise”

32. Page 16 – Chapter Two
    a. Paragraph 4
    b. Line number 1 and 5
    c. Deleted: the comma before (2007)

33. Page 19 – Chapter Two
    a. Paragraph 1
    b. Line 1 (heading)
    c. Changed: “Substitutions” to “How Some Coaches Maintain Intensity During Competitive Play”

34. Page 19 – Chapter Two
    a. Section 2.4.3: Heading
    b. Renamed the heading “Substitutions” to “How Some Coaches Maintain Intensity During Competitive Play”
    c. Explanation: The reason for this section is to explain how some coaches maintain intensity during competitive play in order to alleviate the possibility of fatigue negatively affecting individual and team performance.

35. Page 20 – Chapter Two
    a. Paragraph 1
    b. Line 3
    c. Deleted: s from teams
    d. Inserted: “a comma” after sports

36. Page 20 – Chapter Two
    a. Paragraph 3
    b. Line 1
    c. Inserted: Limited research studies have determined whether high physiological loads have adverse effects on technical and tactical indicators (i.e. centre pass movements). Research shows that there is a detrimental effect in the laboratory, however a lack of research has been completed in a field setting. Determining if there is a difference in physical exertion levels between centre pass successful and unsuccessful movements during competitive match-play is vital for the coach to develop and implement appropriate training programs as well as make data-driven decisions.

37. Page 21 – Chapter Three
    a. Paragraph 1
    b. Line 1
    c. Inserted: in elite netball. Therefore, the junior World Cup tournament and senior national selection camp presented the only feasible opportunity to conduct research of this nature.

38. Page 21 – Chapter Three
    a. Paragraph 2
    b. Line 1
    c. Inserted: In this study, a non-probability sampling technique (convenience sampling) was used, thus no sample size calculation was performed. The available sample was based on the opinions of the national selectors. The players selected for the junior and senior squads, were then invited to participate in this study. Permission was granted by the chief executive officer (CEO) of Netball South Africa for the researcher to approach the junior and senior national teams, approval was also given by the head coaches and finally an invitation was sent to all the players inviting them to participate in this study. Of the elite junior players 100% volunteered to be part of this study, whereas only 79% of the elite senior players volunteered and took part.

39. Page 21 – Chapter Three
    a. Paragraph 3
    b. Line 2
    c. Inserted: range: 20-21

40. Page 21 – Chapter Three
    a. Paragraph 3
    b. Line 3
    c. Inserted: body

41. Page 21 – Chapter Three
    a. Paragraph 3
    b. Line 5
    c. Inserted: range: 20-33

42. Page 21 – Chapter Three
    a. Paragraph 3
    b. Line 5
    c. Inserted: body

43. Page 21 – Chapter Three
    a. Paragraph 4
    b. Line 1
    c. Inserted: that the junior and senior

44. Page 22 – Chapter Three
    a. Paragraph 1
    b. Line 8
    c. Inserted: which highlights that all players were at peak fitness.

45. Page 22 – Chapter Three
    a. Paragraph 2
    b. Line 1
    c. Original paragraph: The national junior netball team played indoors on wooden sprung floors and all the senior selection games were played on synthetic flooring indoors.
    d. Added to and reworded: The national junior netball team were filmed and monitored during seven competitive matches throughout a nine-day international tournament, held in Botswana in July 2017. The matches were played against Australia, Barbados, New Zealand, Jamaica, Uganda, Zimbabwe and Singapore and all games were played indoors on wooden sprung floors. Additionally, three selection matches from a five-day national senior selection camp, held in Pretoria in July 2017, were filmed and monitored to include players from both teams playing against each other. All the selection games were played on synthetic flooring indoors.

46. Page 23 – Chapter Three
    a. Paragraph 4
    b. Line 1
    c. Inserted: The technical and tactical data (duration in possession, number of passes and location of possession lost) were categorized according to the performance level of the team to assess whether there were any differences between the two groups from an experience/age aspect.

47. Page 26 – Chapter Three
    a. Paragraph 1
    b. Line 10
    c. Deleted: that
    d. Inserted: it

48. Page 27 – Chapter Three
    a. Paragraph 4
    b. Line 2
    c. Inserted: Statistical tests chosen were based on the type of data (continuous, discrete, ordinal or nominal), number of groups being analysed (1, 2 or 2 or more), what the hypothesis was testing for (correlation, variances, means or association) as well as the normality of the graph (Marshall, 2016).

49. Page 27 – Chapter Three
    a. Paragraph 5
    b. Line 2
    c. Deleted: There were 621 centre passes documented during the study conducted for Objective 1.

50. Page 28 – Chapter Three
    a. Paragraph 1
    b. Line 1
    c. Deleted: mean ±standard deviation
    d. Inserted: median (IQR)

51. Page 28 – Chapter Three
    a. Paragraph 1
    b. Line 1
    c. Inserted: The Shapiro Wilk Test was used and data was found to be not normality distributed. Therefore,

52. Page 28 – Chapter Three
    a. Paragraph 1
    b. Line 4
    c. Inserted: and number of passes using the Kruskal-Wallis test

53. Page 28 – Chapter Three
    a. Paragraph 4
    b. Line 2
    c. Deleted: A total of 562 centre pass were analysed with 58 centre pass movements disregarded due to technical issues during the data collection phase.

54. Page 28 – Chapter Three
    a. Paragraph 4
    b. Line 3
    c. Inserted: and were tested for normality using the Shapiro Wilk test. The data was found to be not normally distributed, therefore the Kruskal-Wallis test was used to compare the groups for statistical significance

55. Page 29 – Chapter Three
    a. Paragraph 2
    b. Line 1
    c. Deleted: A total of 593 goals scored, 197 missed shots and 184 possession losses were analysed for objective three.

56. Page 29 – Chapter Three
    a. Paragraph 2
    b. Line 5
    c. Inserted: Kruskal-Wallis test. This test was chosen on the basis that the data was found to be not normally distributed using the Shapiro Wilk test

57. Page 31 – Chapter Four
    a. Table 4.1
    b. Line 1
    c. Inserted: t-test
    d. Inserted: (n=12) and (n=19)

58. Page 31 – Chapter Four
    a. Table 4.1
    b. Changed: Expressed the mean and SD of height of both groups to 2 decimal places
    c. Changed: “m = height” to “m = metres”

59. Page 32 – Chapter Four
    a. Table 4.2 Heading
    b. Line 1
    c. Inserted: represented as median (IQR) and mean duration
    d. Inserted: **(Median (IQR)**
    e. Deleted and Inserted: **(Mean ±SD)**

60. Page 32 – Chapter Four
    a. Table 4.2
    b. First column
    c. Deleted: **(Mean ±SD)**
    d. Inserted: **(Median (IQR)**

61. Page 32 – Chapter Four
    a. Table 4.2
    b. Line 2
    c. Inserted: 5 (4-7) and 4 (2-6) and 0.000

62. Page 33 – Chapter Four
    a. Paragraph 1
    b. Line 2
    c. Inserted: The 358 converted CP movements in this study displayed a median of 5 passes (IQR = 4-7) with a minimum number of 2 passes and a maximum of 14 passes. Of the 263 unsuccessful CP movements presented a median of 4 passes (IQR = 2-6) with a minimum number of 0 passes and a maximum of 13 passes (Figure 3). A significant difference ($p < 0.000$) was found between the two CP movements categories.

63. Page 34 – Chapter Four
    a. Paragraph 1
    b. Line number 3
    c. Changed: “> 0.066” to “= 0.066”

64. Page 39 – Chapter Four
    a. Table 4.4
    b. Line 2
    c. Inserted: p-value and p > 0.15

65. Page 39 – Chapter Four
    a. Paragraph 2
    b. Line 1
    c. Deleted: When comparing the following in the 85-95 %HRmax goals scored vs. missed shots, no effect size was found (d = 0.04) and looking at goals scored vs. possession lost, no effect size was found (d = 0.14). However, a small effect size was found between missed shots vs. possession lost (d = 0.2).

66. Page 43 – Chapter Five
    a. Paragraph 2
    b. Line number 2
    c. Changed: “O’Donoghue (2006)” to “O’Donoghue's (2006)”

67. Page 46 – Chapter Five
    a. Paragraph 2
    b. Line number 4
    c. Changed: “lack of findings” to “lack of significant findings”

68. Page 46 – Chapter Five
    a. Paragraph 2
    b. Line number 10
    c. Changed: “proven” to “provided evidence”

69. Page 49 – Chapter Five
    a. Paragraph 2
    b. Line number 1
    c. Changed: “Majority” to “The majority”

70. Page 50 – Chapter Five
    a. Paragraph 2
    b. Line 1
    c. Original paragraph: Due to the national representation of the players involved in this study, the players live and train in different regions of South Africa, it was therefore not possible to conduct any maximal testing to determine heart rate maximum before data collection began.
    d. Inserted and reworded: In order to determine relative heart rate, an age predicted formula was used to calculate maximal heart. Possibly a better method of determining maximal heart rate would have been during a maximal exercise test. However, due to the national representation of the players involved in this study, the players live and train in different regions of South Africa, it was therefore not possible to conduct such tests before data collection began.

71. Page 50 – Chapter Five
    a. Paragraph 5
    b. Line 1
    c. Inserted: Another way to measure physiological responses or levels of exertion accurately would have been through blood lactate testing, however this was not feasible in the international tournament setting.

72. Page 52 – Chapter Six
    a. Paragraph 5
    b. Line 1
    c. Inserted: No difference was found for the mean heart rate of players between successful and unsuccessful CP movements therefore, the researcher fails to reject the null hypothesis and cannot accept the alternative hypothesis.

73. Page 55 – Chapter Six
    a. Reference 1 (on pg. 55)
    b. Line number 2
    c. Changed: “Doctoral” to “B.Sc. Hons”

74. Page 55 – Chapter Six
    a. Reference 2 (on pg. 55)
    b. Line number 2
    c. Changed: “Doctoral” to “B.Sc. Hons”

75. References – Page 60
    a. Reference 2 (on page 60)
    b. Inserted: Marshall, E., 2016. The Statistics Tutor’s Quick Guide to Commonly Used Statistical Tests, viewed 6 June 2018, from http://www.statstutor.ac.uk/resources/uploaded/tutorsquickguidetostatistics.pdf.

Kind regards,

Cristy Mullender
084 741 8888

Master of Science Degree in Medicine in the field of Sport and Exercise Science by dissertation