**Quality Appraisal – modified Downs & Black checklist.**

**Q1.** Is the hypothesis/aim/objective of the study clearly described? (Yes = 1; No = 0)

**Q2.** Are the main outcomes to be measured clearly described in the introduction or methods section? If the main outcomes are first mentioned in the results section, answer no. (Yes = 1; No = 0).

**Q3.** Are the characteristics (age, height, weight, training status, healthy) of the participants included in the study clearly described? In observational studies, inclusion and/or exclusion criteria should be given. In case-control studies, inclusion and/or exclusion and the source of controls should be given. (Yes = 1; No = 0).

**Q4.** Are the interventions of interest clearly described? For exercise interventions, the type, intensity and duration should be described. If they provide a nutritional supplement the exact type, dose and duration should be provided. Treatments and placebo (where relevant) that are to be compared should be clearly described. (Yes = 1; No = 0).

**Q5.** Are the main findings of the study clearly described? Simple outcome data should be reported for all major findings so the reader can check the major analyses and conclusions. This does not cover statistical tests which are addressed in other questions. (Yes = 1; No = 0).

**Q6.** Does the study provide estimates of the random variability in the data for the main outcomes? In non-normal data, inter-quartile range should be reported. In normal data, standard deviation, standard error or confidence intervals should be reported. (Yes = 1; No = 0).

**Q7.** Have all important adverse events that may be a consequence of the intervention been reported. Answer yes if they confirm they have ethical approval (Yes = 1; No = 0).

**Q8.** Was at least one familiarization trial conducted prior to exercise testing? (Yes = 1; No = 0; Unable to determine = 0).

**Q9.** Were the exercise test conditions adequately standardised (factors including time of day; prior nutritional intake (including caffeine) and prior exercise)? (Yes (all relevant factors standardised) = 2; Yes (some relevant factors standardised) = 1; No = 0; Unable to determine = 0).

**Q10.** Was an attempt made to blind study subjects to the intervention they have received?

For studies where the patients would have no way of knowing which intervention they received, this should be answered yes. (Yes = 1; No = 0; Unable to determine = 0).

**Q11.** Was the order of phase testing randomised or counterbalanced? (Yes = 1; No = 0; Unable to determine = 0).

**Q12.** Were the main outcome measures used accurate (valid and reproducible)? Answer yes for tests that have been externally validated (Yes = 1; No = 0; Unable to determine = 0).

**Q13.** Were statistical tests used to assess the main outcomes appropriate? The statistical techniques used must be appropriate to the data and the research question. (Yes = 1; No = 0; Unable to determine = 0).

**Q14.** If any of the results of the study were based on ‘data dredging’ was this made clear? Any analyses that had not been planned at the outset should be clearly indicated. If no retrospective subgroup analyses were reported, then answer yes. (Yes = 1; No = 0; Unable to determine = 0).

**Note:** The maximum attainable score for these studies was 14 and the categories were: High (12 – 14); Moderate (9 – 11); Low (6 – 8); Very Low (< 6).

**Table 1. Quality appraisal results from the studies included in the meta-analysis.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CAF** | **Author (year)** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q6** | **Q7** | **Q8** | **Q9** | **Q10** | **Q11** | **Q12** | **Q13** | **Q14** |  **Total** |
| **1** | Bridge & Jones (2006) | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **12** |
| **2** | Clarke et al. (2016) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **3** | Dolan et al. (2017) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **4** | Flinn et al. (1990) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **5** | Karayigit et al. (2017) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **6** | McNaughton et al. (2008) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **7** | Wiles et al. (2006) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **8** | Saunders et al. (2017) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **9** | Rezaei et al. (2019) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **10** | Grgic et al. (2020) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **Buffers** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **1** | Bird et al. (1995) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **2** | Carr et al. (2011) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **3** | Coombes et al. (1993) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **4** | Coppoolse et al. (1997) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | **13** |
| **5** | Goldfinch et al. (1988) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **6** | Griffen et al. (2015) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **7** | Lindh et al. (2008) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **8** | Materko et al. (2008) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **9** | McLellan et al. (1988) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | **12** |
| **10** | McNaughton (1990) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **11** | McNaughton et al. (1991) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **12** | McNaughton (1992) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **13** | McNaughton (1992) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **14** | McNaughton & Cedaro (1992) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **15** | McNaughton et al. (1997) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **16** | McNaughton et al. (1999) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **17** | Miller et al. (2016) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **18** | Morris et al. (2011) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **19** | Oliveira et al. (2017) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **20** | Painelli et al. (2013) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **21** | Pierce et al. (1992) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |
| **22** | Tiryaki et al. (1995) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | **12** |
| **23** | Wilkes et al. (1983) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **14** |
| **24** | Rezaei et al. (2019) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | **13** |