**Supplementary material**

**Title: The influence of physical activity on neural responses to visual food cues in humans: A systematic review of functional magnetic resonance imaging studies**

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**Supplementary methods**

*Literature search*

*(magnetic resonance imaging OR functional magnetic resonance imaging OR functional MRI OR functional imaging OR fMRI OR brain imaging OR neuroimaging OR blood-oxygen level dependent OR BOLD OR BOLD signal OR neural response OR neuronal response OR brain activity OR neural activation)*

*AND*

*(physical activity OR PA OR exercise OR training OR sport OR acute exercise OR chronic exercise OR exercise training OR exercise program OR physical exercise OR aerobic exercise OR resistance exercise OR strength training OR moderate to vigorous physical activity OR MVPA OR moderate-intensity exercise OR high-intensity exercise OR HIIT OR running OR run OR cycling OR cycle OR walking OR walk OR exertion)*

*AND*

*(food OR hedonic OR pictures OR images OR visual stimuli OR visual stimulus OR food cues OR high calorie OR low calorie OR high-energy OR high energy density OR low-energy OR low energy density OR palatable OR nonpalatable OR non-food OR neutral)*

*AND*

*(appetite OR hunger OR reward OR satiety OR satiation OR pleasure OR food craving OR fullness OR satisfaction OR amygdala OR insula OR hypothalamus OR nucleus accumbens OR orbitofrontal cortex OR OFC OR striatum OR hippocampus OR dorsolateral prefrontal cortex OR DLPFC OR temporal occipital fusiform cortex OR TOFC)*

**Supplementary Table 1.** Details of the search restriction and number of results returned from the seven electronic databases.

|  |  |  |
| --- | --- | --- |
| **Electronic database** | **Search restriction** | **Search results (n)1** |
| **December 2020** | **February 2023** |
| PubMed | Title and abstract | 317 | 376 |
| Scopus | Title and abstract | 1,617 | 2,100 |
| SPORTDiscus2 | Title and abstract | 19 | 28 |
| PsychINFO2 | Title and abstract | 243 | 282 |
| PsycArticles2 | Title and abstract | 2 | 3 |
| The Cochrane Library | No restrictions | 1,061 | 1,461 |
| ClinicalTrials.gov | No restrictions  | 36 | 110 |
|  | **Total** | **3,295** | **4,360** |

1 Search results represent figures before the removal of duplicates.

2 Databases searched simultaneously in EBSCOhost.

**Supplementary Table 2.** Full breakdown of the study quality assessment for the eligible studies using the National Heart, Lung, and Blood Institute (NHLBI) quality assessment tools.

| **Study** | **Criteria** | **Total ‘yes’ responses****n (%)** | **Total ‘CD/NR/NA’ responses** **n (%)** | **Total ‘no’****Responses****n (%)** |
| --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **Before-after studies with no control group (for exercise training interventions)** |
| Cornier et al. (2012) | Y | NR | CD | CD | N | Y | Y | Y | NR | Y | N | Y | - | - | 6 (50.0%) | 4 (33.3%) | 2 (16.7%) |
| **Observational cohort and cross-sectional studies (for acute crossover and cross-sectional studies)** |
| Crabtree et al. (2014) | Y | N | CD | Y | Y | Y | Y | N | Y | N | Y | NA | Y | N | 8 (57.1%) | 2 (14.3%) | 4 (28.6%) |
| Drummen et al. (2019)  | Y | NR | CD | Y | Y | N | N | Y | N | N | Y | NR | NA | Y | 6 (42.9%) | 4 (28.6%) | 4 (28.6%) |
| Evero et al. (2012) | Y | NR | CD | Y | N | Y | Y | N | Y | N | Y | NA | Y | N | 7 (50.0%) | 3 (21.4%) | 4 (28.6%) |
| Kilgore et al. (2013) | Y | N | CD | Y | N | N | N | Y | N | N | Y | NR | NA | Y | 5 (35.7%) | 3 (21.4%) | 6 (42.9%) |
| Luo et al. (2018) | Y | NR | CD | Y | N | N | N | Y | N | Y | Y | NR | NA | Y | 6 (42.9%) | 4 (28.6%) | 4 (28.6%) |
| Masterson et al. (2018) | Y | Y | CD | Y | N | Y | Y | N | Y | N | Y | NA | Y | N | 8 (57.1%) | 2 (14.3%) | 4 (28.6%) |
| Saanijoki et al. (2018) | Y | N | CD | Y | N | Y | Y | N | Y | N | Y | NA | Y | N | 7 (50.0%) | 2 (14.3%) | 5 (35.7%) |

CD, cannot determine; N, no; NA, not applicable; NR, not reported; Y, yes.

**Before-after studies with no control group criterion:** (1) Was the study question or objective clearly stated?; (2) Were eligibility/selection criteria for the study population prespecified, clearly described and appropriate?; (3) Were the participants in the study representative of those who would be eligible for the intervention in the general or clinical population of interest?; (4) Were all eligible participants that met the prespecified entry criteria enrolled?; (5) Was the sample size sufficiently large to provide confidence in the findings?; (6) Was the intervention clearly described and delivered consistently across the study population?; (7) Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?; (8) Were the people assessing the outcomes blinded to the participants' exposures/interventions?; (9) Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?; (10) Did the statistical methods examine changes in outcome measures from before to after the intervention? Were anatomical coordinates for significant voxel clusters reported for the pre-to-post changes?; (11) Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?; (12) If the intervention was conducted at a group level (e.g., a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?

**Observational cohort and cross-sectional studies criterion:** (1) Was the research question or objective clearly stated; (2) Was the study population clearly specified, defined and appropriate?; (3) Was the participation rate of eligible persons at least 50%?; (4) Were all the subjects selected or recruited from the same or similar populations? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?; (5) Was a sample size justification, power description, or variance and effect estimates provided?; (6) Were the exposure(s) of interest measured prior to the outcome(s) being measured?; (7) Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?; (8) For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?; (9) Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?; (10) Was the exposure(s) assessed more than once over time?; (11) Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?; (12) Were the outcome assessors blinded to the exposure status of participants?; (13) Was loss to follow-up after baseline 20% or less?; (14) Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?