**Supplementary Table 1 -**

Detailed review table of studies assessing verbal short term memory (vSTM) and verbal working memory (vWM)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Authors** | **Cohort & Design** | **Mechanism** | **Test(s) used** | **Findings + Comments** |
| **VERBAL SHORT-TERM MEMORY** | | | | |
| **Hatch et al. (2010)**  **[10]** | Behavioural study  Cross-sectional + Longitudinal (before & after weight gain)  Adolescent AN (12-18) vs. HC  (n= 37AN, 45HC) | vWM | NBack (IntegNeuro battery): 1-back was used to assess sustained attention and working memory). All participants took the test twice, in the case of ANs, after BMI had risen to a healthy standard after therapy. | No difference was found in underweight AN vs. HC but weight-gained AN made less false positive errors than HC. Overall, nutritional therapy improved cognitive performance in AN in speed, memory, attention and executive function tasks |
| **Castro-Fornieles et al. (2010)**  **[11]** | fMRI + Behavioural study  Cross-sectional + Longitudinal  Adolescent RAN + BPAN (11-18) vs. HC  (n= 14AN, 14HC) | vWM | NBack: Digit 1-back task ANs with significant weight recovery after treatment were scanned and tested again after 7 months. Correlational analysis was also carried out with Children’s depression inventory and BMI | No difference in task performance. Hyperactivation found in parietal and temporal areas in AN. Decreased activation in these areas and the anterior cingulate cortex found after weight recovery.  Comparison with HC at follow-up showed no difference.  Correlations found between activation and BMI (-) and children’s depression inventory (+) |
| **Bosanac et al. (2007)**  **[12]** | Behavioural study  Cross-sectional  UAN vs. BPAN vs WRAN vs. HC  (n= 16UAN, 16HC) | vSTM capacity | Immediate recall (word list) | BPAN and WRAN significantly worse at immediate recall. However, no difference found between HC and RAN |
| **Key et al. (2006)**  **[13]** | Behavioural + SPECT rCBF study  Cross-sectional  Adult AN (no co-morbidity) vs. HC  (n= 11AN, 11HC) | vSTM capacity + WM | Digit span forward and backwards combined | No difference between AN and HC  Hypoperfusion found in the anterior temporal lobe and caudate nuclei in majorty of subjects |
| **Kemps et al. (2006)**  **[14]** | Behavioural study  Cross-sectional  AN (17-27) vs. dieting HC vs. non-dieting HC  (n= 24AN, 24HC) | vWM, vsWM & CE | Double span memory task: Series of common objects shown on-screen in different grid locations. Requires naming the objects (vWM), pointing to location (vsWM) or both (CE) | No difference in vWM. For CE, non-dieting HC > dieting HC & AN. For vsWM, AN were significantly poorer than other groups. Effect disappeared after co-varying with ‘preoccupying cognitions’ |
| **Mathias & Kent (1998)**  **[15]** | Behavioural study  Cross sectional  AN vs. HC  (n=34AN, 31HC | vSTM capacity | RAVLT immediate recall portion (test 6 – second word list) | No difference between the two groups |
| **Szmukler et al. (1992)**  **[16]** | Behavioural study  Cross-sectional + longitudinal weight gain  AN vs. HC  (n =18AN, 18HC) | vSTM capacity | RAVLT  Serial digit learning task | No difference between AN and HC at time 1  Significant effect of time at follow-up whereby participants improved performance |
| **Witt et al. (1985)**  **[17]** | Behavioural study  Cross sectional  AN vs. Depressed vs. Diabetic vs. HC  (n= 16AN, 16HC | vSTM capacity | Digit span forwards | No difference between the groups |
| **Castro-Fornieles et al. (2009)**  **[18]** | Behavioural and structural imaging (VBM) study  Cross-sectional + Longitudinal  Adolescent AN (11-17) vs. HC  (n= 12AN, 9HC) | vSTM | WISC-R (including digit span)  Grey matter + white matter volumes | At 1st assessment, AN worse at digit span and have less grey matter (including left inferior parietal cortex)  No difference in digit span scores at follow-up, but there was an increase in grey matter |
| **Green et al. (1996)**  **[19]** | Behavioural study  Cross-sectional  RAN (17-43) vs. HC (18-25)  (n = 12AN, 17HC) | Attention and vSTM capacity | Bakan Vigilance Task (BVT): Shown continuous stream of numbers, required to respond when either 3 odd / 3 even numbers appear.  Immediate free recall (IFR): 20 words presented, 1 every 1or2 seconds. 4 minutes given to remember as many words as possible | BVT: No difference in hit rate between groups.  IFR: AN recalled fewer words than HC overall. AN recall not affected by presentation speed but HC were better with 2s presentation speed.  Taken together this indicates that AN have poorer STM capacity |
| **Kingston et al. (1996)**  **[2]** | Behavioural study  Cross-sectional  AN vs. HC  (n= 46AN, 41HC) | vSTM capacity | Immediate recall of prose passages  Supraspan digit sequence | Both tests indicate that AN perform significantly worse than HC. No difference in scores over time |
| **VERBAL WORKING MEMORY** | | | | |
| **Brooks et al. (2012)**  **[20]** | Behavioural study  Cross-sectional  RAN vs HC  (n= 13RAN, 20HC) | vWM | NBack: 1-back and 2-back with presentation of letters interspersed with subliminally presented task-irrelevant stimuli (food, aversive and neutral). | Overall, RANs made less errors in both n-backs than HCs but high performance was compromised to the level of HCs when food stimuli were presented subliminally |
| **Dickson et al. (2008)**  **[5]** | Behavioural study  Cross-sectional  RAN vs HC  (n= 24AN, 24HC) | vWM | NBack: 1-back and 2-back with presentation of letters interspersed with sub/supraliminally presented task-irrelevant stimuli (food, aversive and neutral). | General stimulus-independent attentional impairment at a conscious processing level. However, RAN demonstrated ability to concentrate when they cannot see irrelevant stimuli  RAN superior during subliminal testing, inferior during supraliminal testing |
| **Nikendei et al. (2011)**  **[4]** | Behavioural study  Cross sectional  RAN vs. BPAN vs WRAN vs. HC  (n= 34AN, 30HC) | STM capacity + vWM | Immediate recall of prose passages + Digit span forwards  Digit span Backwards | Patient groups performed poorer on immediate recall showing defective contextual STM processing. Main effects of group for digit span forwards and backwards were non-significant but only following Bonferroni adjustment for 11 tests. The data appear to show up to a 2 point difference between patient groups and HC for digit spans |
| **Seed et al. (2002)**  **[21]** | Behavioural study  Cross sectional  AN vs. HC  (n= 20AN, 20HC) | STM capacity + vWM | Immediate word recall (15 word list).  Memory scanning: Initial presentation of 5 digits. 30 subsequent digits presented, subjects choose ‘yes’ or ‘no according to whether the digit is one of the 5 presented at the start | Immediate recall: no difference in number correct but AN made more errors  Memory scanning: no difference on sensitivity index, but AN had significantly slower reaction times |
| AN = Anorexia Nervosa  BPAN = Anorexia Nervosa binge/purge subtype  RAN = Anorexia Nervosa restrictive subtype  UAN = Underweight Anorexia Nervosa  WRAN = Weight-restored Anorexia Nervosa  BMI = Body mass index  BN = Bulimia Nervosa  CE = Central Executive  fMRI = functional magnetic resonance imaging  HC = Healthy control  RAVLT = Rey auditory verbal learning test  rCBF = regional cerebral bloodflow  SPECT = single-photon emission computer tomography  VBM = voxel-based morphometry  vsWM = visuospatial working memory  WISC-R = Wechsler intelligence scale for children – revised | | | | |

**Supplementary Table 2 -**

Number of AN participants taking psychoactive medications at the time of study

|  |  |  |
| --- | --- | --- |
| **Medication type** | **No. of participants** | **Specific medications** |
| **Anti-depressants** | 6 | Fluoxetine (SSRI) |
| 4 | Citalopram (SSRI) |
| 1 | Escitalopram (SSRI) |
| 1 | Sertraline (SSRI) |
| 1 | SSRI not defined |
| 1 | Venlafaxine (SNRI) |
| **Anti-anxiolytics** | 2 | Pregabalin |
| 1 | Propranolol (Beta-blocker) |
| 1 | Not defined |
| **Analgesics** | 1 | Solpadol |
| **Anti-epileptics** | 1 | Lamotrigine |

Supplementary Table 3 -

Table showing the location of clusters exhibiting a significant linear trend in activation (voxel-wise threshold = 0.05) across vWM conditions, within each group. Only clusters surviving FDR correction are reported. Coordinates are within Talairach space and correspond to the peak voxel in each cluster. BA = Brodmann’s area; R/L = right and left hemisphere respectively.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Group** | **Trend** | **Talairach Labels** | | **BA** | | **Side** | **Coordinates** | | | **Cluster size (voxels)** | **Cluster *p*-value** |
|  |  |  | |  | |  | *x* | *y* | *z* |  |  |
| **AN** | **Positive** | Middle Temporal Gyrus | | 21 | | L | -51 | -22 | -13 | 122 | 0.007 |
|  |  | Inferior Parietal Lobule | | 40 | | R | 43 | -44 | 37 | 240 | <0.001 |
|  |  |  | | 40 | | L | -33 | -44 | 31 | 147 | <0.001 |
|  |  | Precuneus | | 7 | | L | -25 | -63 | 42 | 175 | <0.001 |
|  |  |  | | 7 | | R | 14 | -67 | 42 | 228 | <0.001 |
|  |  | Middle Frontal Gyrus | | 6 | | R | 25 | 4 | 48 | 200 | <0.001 |
|  |  |  | | 6 | | L | -25 | 0 | 48 | 211 | <0.001 |
|  |  |  | | 9 | | L | -40 | 26 | 31 | 177 | <0.001 |
|  |  |  | | 9 | | R | 36 | 30 | 31 | 214 | <0.001 |
|  |  | Superior Frontal Gyrus | | 10 | | L | -29 | 48 | 15 | 94 | 0.002 |
|  |  |  | | 10 | | R | 29 | 59 | -2 | 91 | 0.006 |
|  |  |  | | 6 | | L | 0 | 7 | 48 | 208 | <0.001 |
|  |  | Inferior Frontal Gyrus | | 45 | | L | -29 | 26 | 4 | 115 | 0.002 |
|  |  | Insula | | - | | R | 29 | 22 | 4 | 139 | 0.001 |
|  | **Negative** | Medial Frontal Gyrus | | 10 | | R | 0 | 56 | 4 | 150 | 0.004 |
|  |  | Posterior Cingulate | | 30 | | L | -7 | -52 | 9 | 363 | 0.003 |
|  |  | Postcentral Gyrus | | 2 | | L | -54 | -19 | 31 | 214 | 0.005 |
|  |  | Superior Frontal Gyrus | | 9 | | L | -7 | 56 | 31 | 106 | 0.002 |
|  |  |  | | 8 | | L | -7 | 41 | 42 | 147 | 0.002 |
|  |  | Cingulate Gyrus | | 31 | | L | -7 | -33 | 37 | 1347 | 0.001 |
|  | | | | | | | | | | | |
| **HC** | **Positive** | Cerebellar Tonsil | - | | R | | 40 | -56 | -35 | 180 | 0.007 |
|  |  | Supramarginal Gyrus | 40 | | R | | 36 | -44 | 31 | 437 | <0.001 |
|  |  |  | 40 | | L | | -43 | -44 | 31 | 156 | <0.001 |
|  |  | Precuneus | 7 | | L | | -22 | -67 | 42 | 250 | 0.001 |
|  |  | Superior Frontal Gyrus | 6 | | L | | 0 | 7 | 48 | 196 | <0.001 |
|  |  |  | 9 | | R | | 40 | 33 | 26 | 279 | 0.001 |
|  |  | Middle Frontal Gyrus | 6 | | L | | -25 | -4 | 48 | 176 | <0.001 |
|  |  |  | 9 | | L | | -43 | 19 | 31 | 218 | 0.001 |
|  |  |  | 10 | | L | | -29 | 44 | 20 | 126 | 0.001 |
|  |  |  | 6 | | R | | 25 | 0 | 53 | 234 | <0.001 |
|  |  | Lentiform Nucleus | - | | L | | -14 | 0 | 4 | 102 | 0.007 |
|  |  | Caudate | - | | R | | 14 | 4 | 9 | 154 | 0.006 |
|  |  | Claustrum | - | | L | | -25 | 22 | 4 | 122 | 0.001 |
|  |  | Insula | 13 | | R | | 33 | 19 | 4 | 206 | 0.002 |
|  | **Negative** | Medial Frontal Gyrus | 10 | | R | | 7 | 56 | 4 | 55 | 0.007 |
|  |  | Posterior Cingulate | 30 | | L | | -7 | -52 | 15 | 348 | 0.002 |
|  |  | Superior Frontal Gyrus | 9 | | L | | -11 | 52 | 26 | 181 | 0.002 |
|  |  |  | 9 | | R | | 11 | 52 | 31 | 93 | 0.003 |
|  |  | Cingulate Gyrus | 31 | | L | | -7 | -33 | 37 | 992 | 0.001 |
|  |  |  | 24 | | L | | 0 | -15 | 37 | 394 | <0.001 |
|  |  | Postcentral Gyrus | 3 | | R | | 47 | -19 | 42 | 542 | 0.002 |