**APPENDIX 1**

**Description of tasks within the cognitive test battery**

***Go-NoGo***

This task measured sustained attention and inhibition. It was adapted from a previous version shown to be sensitive to flavonoid supplementation [1]. In this Go-NoGo task, a series of stimuli consisting of the letters ‘X’ and ‘Y’ as well as numbers, were presented for 900ms on a computer screen and participants were asked to press a key corresponding to each stimulus. The task consisted of two types of trials: pre-potent ‘Go’ trials where the letters ‘X’ and ‘Y’ were presented alternately and ‘NoGo’ trials (lures) where the predictable pattern was disrupted with a number. There were 60 trials in total which took the volunteer approximately six minutes to complete. The primary dependent variable was reaction time for correct responses.

***Stroop***

The version of the Stroop task used in this research was a modified version of the original [2]. During this task, participants were presented with the words ‘GREEN’, ‘BLUE’, ‘RED’ and ‘YELLOW’, which were displayed either in the same colour ink as the meaning of the word (congruent trials) e.g. the word ‘RED’ presented in the colour red, or in a colour inconsistent with the meaning of the word (incongruent trials) e.g. the word ‘RED’ displayed in the colour blue. The participant is instructed to respond to the colour in which the word is presented rather than the meaning of the word, by pressing a corresponding key on the keyboard. There were 96 trials in total and the task lasted for approximately four minutes. The primary dependent variable was reaction time for correct responses.

***Digit Switch***

This task was a modified version of the switching task reported by DiGirolamo et al. [3]. At the beginning of each trial a coloured box flashed on screen for 150ms and was followed by a number string which remained on the screen for 2850ms. The digit strings consisted of numbers which were all the same e.g. 3333. The colour of the box depicted which task was to be performed.

The participant was first presented with 40 trials where the digit string was presented following a red square and the participant had to determine whether the value of each digit was greater or less than five (digit value task). E.g. if ‘222222’ was presented the answer would be < 5 as the value of the individual digit (i.e. 2), is less than 5. This was followed 40 trials where the digit string was followed by a blue square and the participant had to decide whether the total number of digits presented was greater or less than five (digit numerosity task). E.g. if ‘999’ was presented, the answer would also be < 5 as there are only three digits presented in total. For both types of trial, the answer was never five. There were an equal number of stimuli in each condition with values less than and greater than five and also with the number of digits less than and greater than five. The digit value only and digit numerosity only blocks created the non-switch conditions in that the participant was not required to change from one task to the other.

Finally, the participant was presented with 40 trials which were a random mix of red and blue trials (the switch condition) requiring the participant to switch tasks according to the type of trial presented. The task lasted approximately six minutes and the primary dependent variable was switch cost reaction time (total reaction time in the switch condition minus the average of total reaction time in the two non-switch conditions).

***Continuous Performance Task***

This task was based on the Continuous Performance Task reported by Ogg et al. [4]. Participants were presented with a random series of letters from the English alphabet and were required to press the space bar on the keyboard in response to each letter, except for when the letter ‘X’ appeared. Each letter remained on the screen for 250ms and the inter stimulus interval was 1000ms. The task lasted for six minutes. The primary dependent variable was total number of commission errors i.e. the number of times the participant responded on seeing the letter ‘X’.

***Digit Symbol Substitution Test***

This task is a subtest of the WAIS-R [5] where it is combined with other tests to give a performance IQ score. Participants were given a sheet of paper with a key at the top, showing numbers one through to nine each paired with a symbol. Below the key there were four rows of 25 boxes, each containing a number from one to nine with a blank box underneath. The numbered boxes were in a random order. Starting at the beginning of the first row and working from left to right down the page, participants were asked to draw the correct symbol in the blank box using the key at the top of the page. Participants were given 90 seconds to fill in as many boxes as possible in sequential order and the total number of correctly completed boxes was the primary dependent variable.

***Random Word Generation***

Word generation was used as a measure of verbal fluency and was adapted from the FAS measure of phonemic fluency [6, 7]. Participants were given 30 seconds to say as many words as possible beginning with a verbally presented letter e.g. ‘M’, which was similar to the method used by Miyake et al. [8]. Three letters were presented in total over the course of 90 seconds (one letter every 30 seconds). Participants were asked to avoid repetition, as words they had already stated were only counted once; to avoid saying Proper nouns; and to refrain from pluralising words or using the same word stems but changing the ending to create different words. The total number of valid words generated was the primary dependent variable.

***Three-word Sets Task***

This problem solving task was based on that of Bowden and Jung-Beeman [9] and the problems were sourced from that paper. Participants were presented with 10 problems in sequential order, each consisting of three words and they were asked to write down on a response sheet, a word which linked the three words presented. Each problem was displayed for 30 seconds after which the next problem was presented. The task lasted for approximately five minutes. The primary dependent variable was total number of correct answers out of 10.

***N-back***

This task was a modified version of N-back tasks used in previous research [10, 11] and involved comparing a current stimulus to one presented ‘N’ items previously [12]. The participant was asked to indicate whether or not the number before the immediately preceding number was the same as the current number (N = 2 back), by pressing the appropriate key on the keyboard (‘yes’ or ‘no’). There were 30 trials presented, but when analysing the data from this task, the first two were disregarded as a response was only required from the third trial onwards. The primary dependent variable was percentage correct.

***Letter memory***

This task was based on the one reported by Miyake et al. [8]. For each trial, either 5, 7, 9, or 11 letters were presented sequentially on a computer screen. There were three trials of each letter string length per run of the task. The aim was to recall the last four letters of each letter string presented. E.g. if the following letters had appeared on the screen in sequential order: S, T, H, N, Q, R, F, the answer would be ‘NQRF’. To ensure that the task required continuous updating, the participants were asked to carry out forward serial recall of the last four letters i.e. to say aloud the most recently presented four letters in the order in which they appeared on the screen, by forgetting the first letter of the previous four and adding the most recent letter onto the end of the string. E.g. S, ST, STH, STHN, THNQ, HNQR etc. The number of letters presented was unpredictable which not only varied the level of difficulty but was also to ensure that participants followed the instructed strategy and continuously updated their working memory representations until the end of each trial. This task took approximately seven minutes to complete. The primary dependent variable was the total number of correct answers, which was only awarded if all four letters were recalled and in the correct order.

***Location Task***

This task was a modified version of the ‘Location’ task used by McCarthy et al. [13]. At the start of the task the participant saw a fixation cross in the centre of the computer screen. A black square then appeared in one of 20 possible locations. The square remained on the screen for 1250ms before it disappeared and there was a 1250ms interval before the next square appeared. The participant was required to observe the square and only press the space bar on the keyboard when the square returned to a location it had previously occupied i.e. if it appeared in the same location twice. The square did not appear in the same location more than twice. The test lasted approximately three minutes. Adjusted correct (i.e. total number correct minus false positives) was the primary dependent variable.

***Immediate and delayed recall***

This was a computerised, modified version of the CERAD (Consortium to Establish a Registry for Alzheimer’s Disease; Welsh et al. [14]) free recall task and allowed uniform presentation of the stimuli. Fifteen words were presented sequentially at a rate of one every 2000ms and remained on the screen for 2000ms. This encoding phase lasted approximately 60 seconds. After all 15 words had been presented, instructions appeared on the screen asking the volunteer to say aloud as many of the words as they could remember in any order and in their own time. Participants typically took approximately a minute to do so.

For delayed recall, participants were asked to recall as many of the words from the list presented to them on the computer screen earlier in the session as they could remember. Again, they were given as much time as they needed to do this and could recall the words in any order. Recall took approximately a minute and the delay between encoding and retrieval for this task was at least 15 minutes. During this delay, the participants completed other cognitive tasks in the test battery. The primary dependent variable for immediate and delayed free recall was the number of words correctly recalled.

***Immediate and delayed recognition***

These tasks were computerised and modified versions of the CERAD immediate and delayed word recognition test [15].

For the immediate recognition test, volunteers were presented with all 15 words from the encoding session (the word list presented during the immediate recall task) and 15 new words as distractors, making a total of 30 words presented. Volunteers were asked to indicate whether or not they had seen the word previously (during the encoding session) by pressing the key corresponding to ‘yes’ or ‘no’ on the keyboard. Each word remained on the screen until the volunteer made a response. The ISI was 2000ms and the task lasted approximately 90 seconds. The primary dependent variable was adjusted correct i.e. the number of correctly recognised ‘targets’ (words presented previously during the encoding phase of the immediate recall task) minus false positives (distractors incorrectly identified as having been seen before).

For delayed recognition, the task was repeated following a delay of at least 15 minutes from the time of encoding. Task duration and the primary dependent variable were the same as for the immediate recognition task.

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