

## **Food and fluid intake among endurance event participants: study findings**

**Liverpool John Moores University**

**Elizabeth Mahon**

During the 2009 Longmynd Hike, 23 participants agreed to take part in a nutrition study carried out by Liverpool John Moores University. It was hoped that the data produced from this research would enable links to be made between diet and performance in such events.

Participants who agreed to take part carried out the following tests:

1. Dietary information – participants recorded all the food and drink they consumed in the seven days prior to the event, and all the food that they ate during the event.
2. Hydration status was assessed via a urine sample both before and after the race.
3. Physical performance tests including: jump; balance; and grip tests were performed before and after the race.
4. Cognitive performance tests including reactions time tests and the Stroop test were performed before and after the race.
5. Participants were asked to rate their feelings of exertion, hunger, thirst, tiredness etc before and after the race.
6. Participants completed a questionnaire informing us of their estimated water consumption; their well-being during the event; and whether they had an incident or lost their way.

Please find below the findings of this research which have been split into three sections: average macronutrient intakes related to performance; the hydration status of participants; and the cognitive performance and well-being of participants.

**The macronutrient intakes of recreational endurance athletes prior to, and during, the Longmynd Hike**

The popularity of hill walking/running, both as a leisure time activity and as a competitive sport, is rising. Participation in endurance events such as mountain marathons is increasing as evidenced by the number of new races of these types being established each year, yet analysis of the nutritional intake and requirements of this group of athletes have received relatively little attention.

**Results:**

Macronutrient intakes are shown in the table below.

Food consumed during the event – There were no significant differences in nutrient intakes during the event between age groups, gender or level of experience. Higher intakes of energy and carbohydrate (CHO) were associated with better performance (performance was calculated as a percentage of the winner’s time in their age and gender category). In addition those who consumed higher levels of CHO performed better in the balance tests. Fat and protein showed no significant associations with performance.

Food consumed in the week prior to the event - No significant changes in nutrient composition of the participants’ diets were detected during the week prior to the event (e.g. as a group there was no particular evidence of increased carbohydrate or energy consumption in the days before the event). Both higher intakes of energy and CHO in the week prior to the event were positively associated with performance, whereas increased fat consumption showed a negative correlation with performance.

**Average macronutrient intakes of the group**

		Energy		CHO		Fat		Protein	
		Total (kcal)	kJ/kg/hr	g/kg/hr	% of total energy	g/kg/hr	% of total energy	g/kg/hr	% of total energy
Food inventory	Mean	2351.1	9.0	0.38	65.7	0.06	24.3	0.055	10.0
	SD	938.2	4.4	0.22	12.6	0.04	9.5	0.050	5.2
		kcal/d	kJ/kg/d	g/kg/d	% of total energy	g/kg/d	% of total energy	g/kg/d	% of total energy
7-day food diary	Mean	2515.9	147.3	4.6	49.4	1.3	32.0	1.4	16.8
	SD	512.1	35.7	1.1	5.4	0.40	6.0	0.35	4.9

Comparison of the group’s nutrient intakes with those recommended by the American College of Sports Medicine (they provide generic recommendations based on reviewing the available literature) suggest that whilst the group’s fat and protein intakes are within the recommended range (fat 20-35% total energy; protein 1.2 to 1.4g/kg/d), CHO intakes both

pre-event (recommendation: 6 – 10g/kg/d) and during (70% of participants consumed less than the recommended 30-60g/h), may be sub-optimal for performance.

### **The hydration status of recreational endurance athletes during the Longmynd Hike**

Changes in hydration status have been shown to have deleterious effects on mental decision making, physiological functioning and temperature regulation, the latter an important safety consideration in the mountains. This study assessed the hydration status of recreational endurance athletes taking part in the Longmynd Hike and the implications on performance and well-being markers.

#### **Results:**

Urine analysis showed a decrease in hydration status from pre to post event. No significant differences in hydration were detected between age groups or gender and no associations were found with body temperature, time taken to complete the race or physical performance measures.

Those who were more dehydrated at the end of the race actually had improved reaction time scores over those who were less dehydrated, suggesting that dehydration at this level does not appear to impair ability to carry out such cognitive tasks. However, those who were more dehydrated tended to report higher feelings of nausea and were more likely to have experienced stomach discomfort or to have had a significant incident during the event. These findings suggest that although the changes in hydration status that were detected did not significantly affect performance, they did impact on the participants' well-being.

Of further interest is the data gathered on estimated water consumption. Recommended fluid intakes range between 400 and 800 ml/h. Figure 1 shows over 20% of participants reporting consumption less than this and over 12% more. Therefore overhydration as well as dehydration could also represent as a risk in some participants, particularly those moving at a slower pace.

**Figure 1. Estimated water consumption**

<b>Estimated water consumption (L/h)</b>	<b>&lt; 0.25</b>	<b>0.25 -0.5</b>	<b>&gt; 0.5 -1</b>	<b>&gt; 1</b>
<b>Participants (%)</b>	21.7	52.2	13.2	12.9

## The influence of macronutrient intake on well-being and cognitive performance

Whilst the majority of sports nutrition research assesses the effects of nutrition on physical performance there have been fewer studies focusing on cognitive performance and general well-being, the latter perhaps being as, if not more, important to the recreational athlete than overall performance. Recent years have shown an increasing trend in the number of hill-walking/mountain incidents and cognitive fatigue may be a causal factor of such incidents as it is key in areas of orientation, safety, decision making and reactions to challenging situations.

### Results:

Those who consumed more protein during the event tended to score their perceived rate of exertion, and their post-race scores of tiredness and mental fatigue higher than those who consumed less. No associations were found with intakes of fat, CHO or energy and well-being markers.

Those who consumed higher amounts of energy and CHO performed better on the post-race reaction time tasks indicating carbohydrate and energy may be beneficial in sustaining vigilance and perception during prolonged exercise. Such attributes appear to be important in mountain marathon events as those who lost their way during the race tended to perform less well on the reaction time tasks.

Previous research regarding cognitive function and diet composition at rest has reported limited evidence regarding the effects of macronutrients (such as protein, fat and carbohydrate). However, the findings from this study suggest that perhaps in a fatigued, potentially energy-deficient state, the macronutrient composition of the diet may play a more significant role. It appears that increasing CHO and decreasing protein consumption during endurance events may help to improve cognitive performance and well-being, respectively.

**Thank you to those of you who agreed to take part in this study, the time you gave up is very much appreciated. Thank you also to the organisers of the Longmynd Hike who gave their permission for this study to be carried out and who helped with the organisation. We hope that you find these results interesting/useful.**