



Claire Chaudhry
Community
NHS Dietitian/
Private Sports
Dietitian, Claire
Sports Nutrition
Consultancy

In Claire's 13 years' experience, she has worked in acute and community NHS settings. She has taught nutrition topics at universities and colleges and regularly provides talks to groups, in the NHS and in private practice (www.dietitian.claire.com).

SPORTS NUTRITION: CASE STUDY

In this case study, Claire Chaudhry examines how poor nutritional intake affects an athlete's ability to train, recover from training, compete and continue to compete.¹

Coaches and athletes are more aware than ever that in sport, diet is essential to improving health and sports performance. Good nutrition enables athletes to build and repair

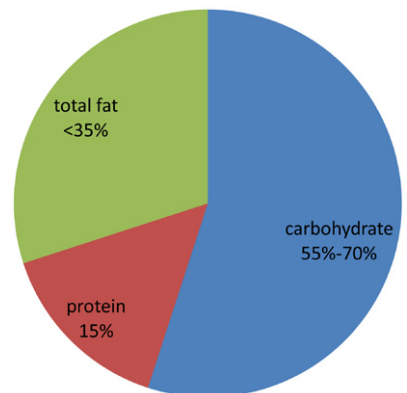
body tissue, regulate metabolism, obtain energy and nutrients, maintain immune function and effectively utilise glycogen stores when required for sports performance.

Client A, Adult, Male, Runner

Identification of nutritional need: dietetic aims of sports nutrition

Aid performance pre-, during and post-exercise; reduce fatigue, increase endurance and aid recovery of the body.

- Maintain sufficient dietary carbohydrate intake during training and competition.
- Maintain energy balance.
- Maintain muscle glycogen levels.
- Maintain weight.
- Maintain sufficient fluid intake, to maintain normal thermoregulatory function during exercise. Preventing dehydration which can reduce physical ability and increase fatigue.
- Maintain adequate dietary micronutrients, i.e. calcium and iron.



Pie Chart 1: Recommendations of percentage of daily kcal requirements from 3 macronutrients in sports nutrition

1. Assessment

Client A is a male, age 36, weight 78kg, height 6 foot 1 inch BMI = 22.6.

BMI in athletes provide limited information on body composition due to increased muscle mass in the athlete. Client A completed a food diary and consecutive physical activity level (PAL) diary for seven days in October 2015. PAL diary reveals that client A is a regular outdoor runner with combined strength training. Client A averages >2 hours intensive running weekly, divided into two by one-hour + running sessions across a mixture of forest and road terrain. He adds in 10 minutes of strength training half way through his runs with press ups, sit ups and pull ups at his local outdoor gym. In the past he has trained and completed many competitive runs: The Great North Run www.greatrun.org/great-north-run and The Mighty Deerstalker www.ratrace.com/mightydeerstalker.

He is currently training to compete in the Wales trail marathon www.trailmarathonwales.com in June 2016 and a Tough Mudder www.toughmudder.co.uk in September 2016.

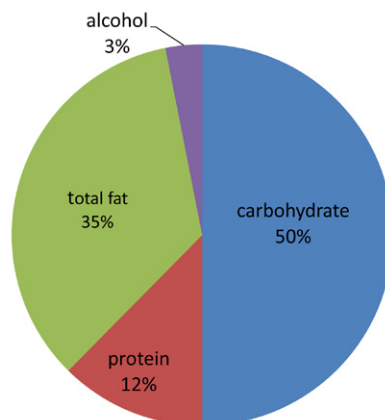
Client A wanted to assess his macro and micro nutrients to ensure he is obtaining good nutrition in order to train, compete and recover.

Table 1: Client A's calculated requirements

| Nutrients and fluid | Client A's calculated requirements ^{2,3,4,5,6,7} |
|----------------------|--|
| Kcal (calories) | 3060-3363kcal |
| Carbohydrate | 390gm-780gm (higher range race day) (or providing 55-70% (higher range race day) of total kcal |
| Protein | 93gm-132gm (providing 15% of total kcal) |
| Fat | Lower weight <20% of total kcal intake Higher weight <35% of total kcal intake Of total fat: Saturated fat <11% and Trans fats <2% |
| Vitamin and minerals | Diet to meet DRVs EAR/RNI. Supplements not required unless low intake in diet and or deficiency has been recognised |
| Fluid | 1950-2730mls or 2.5litres per day as a male |

2. Identification of nutrition and dietetic diagnosis

Client A's diet is very varied; he eats regularly and understands the importance of glycogen storage in muscles and liver and the need for carbohydrates. Using a nutritional analysis programme, web based and based on McCance and Widdowson,⁸ Client A's average mean daily intake over the seven days was calculated and compared with the recommendations:



Pie Chart 2: Percentage of daily mean kcal provided by 3 macronutrients (+alcohol) for client A over 7 days

Calories

2798kcal which are slightly under his recommendations calculated (3060-3363kcal daily). However, his daily kcal range varied from 1958kcal to 5088kcal daily. Over a seven-day period his dietary intake met his kcal requirements.

Protein

86.5gm of protein which is slightly under his calculated requirements (93gm-132gm). His mean intake provided 12% of his total kcal from protein, Client A's target is aiming for 15%. His protein daily intake ranged from 48gm to 135gm. There was only one day when he didn't meet the protein requirements for the general population (55gm of protein).

Carbohydrate

373gm of Carbohydrate which is slightly under his recommendations over seven days (390gm-780gm) providing 50% of his total kcal intake from carbohydrate. Client A's target is between 55-70%. His intake ranged from 281gm to 541gm. The ratio of simple sugars (glucose to fructose) can be an important factor in running. A runner may benefit with more glucose to fructose ratio during training to help with greater absorption and less gastrointestinal (GIT) disturbances.⁹

Client A's diary showed the mean intake of his glucose was higher than the fructose. Client A only suffers from GIT disturbances after competitive races.

Fibre

22gm of NSP and 22.6gm of AOAC daily fibre from Client A, therefore meeting the daily recommendation from SACN report, 2015, adults 18gm-30gm daily.¹⁰

Fat

Total fat provides 107gm (963kcal daily) which is nearly 35% of his total kcal intake. Out of the total fat, mean saturated fat intake is 35gm (providing 11% of total kcals) and trans fat 1.3gm (providing 0.4% of total kcals). The population of the UK on average gets 12.6% of their energy (kcal) from saturated fats. The average male should aim to have no more than 30g of saturated fat a day (<11% from total kcals). Trans fats aiming for <2%, for adults this is no more than about 5.0g a day. Client A's diet shows that his saturated fat consumption was higher than it should be, but lower than the general population. His trans fats consumption was low.

Fluid

Client A's mean intake over seven days is 1383mls from dietary intake, i.e. fruit, coffee, wine, beer and milk. He also drinks at least two litres of water daily averaging 3383mls daily. Client A monitors his urine output and increases his fluid intake after exercise.

Vitamins and minerals

The average mean intake of his vitamins and minerals met his required DRVs - RNI for Client A, apart from selenium, zinc and potassium. (See Bar Chart 1.)

Sodium

Mean sodium levels were high; although you would expect to see that in the general population.

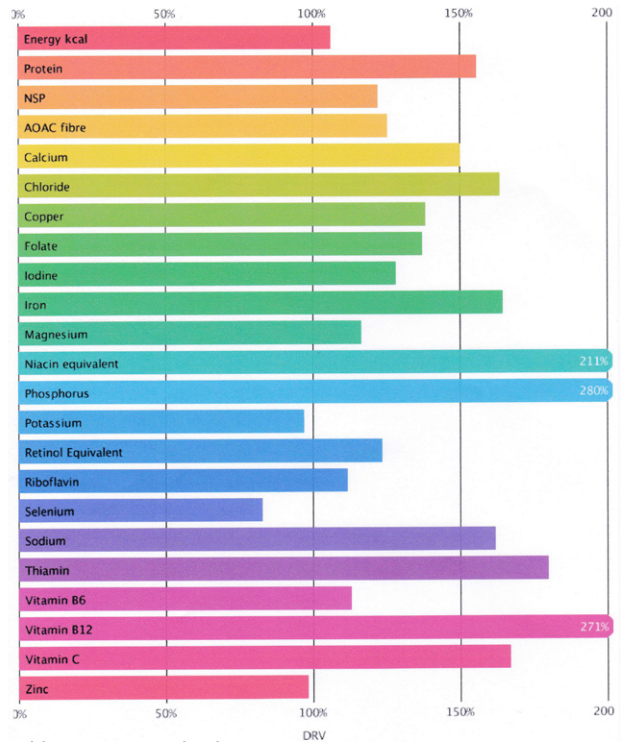
Vitamin D

Vitamin D is essential in the adult body for bone health and in some studies on adult males, there is a link with muscle strength.¹¹ In the UK, an RNI has not been set for groups in the population, considered to receive adequate sunlight exposure. There is an assumption that the amount of vitamin D produced by exposure to summer sunlight, would produce enough vitamin D for their needs during winter. Client A does not fall into any of the categories that require a vitamin D supplement, i.e. pregnancy, lactation or a male over 50 years old which is 10mcg daily.

Client A's mean vitamin D intake over seven days was 1.5 micrograms, this ranged from 0.1-3.1 micrograms daily. The sun provides 80-90% of Vitamin D requirements absorbed through the skin. Food sources, i.e. salmon, tuna, pilchards, mackerel, eggs and dairy, provide between 10-20%. SACN reported that, 'Adults with 35% skin area exposed (equivalent to wearing modest shorts/skirt and T-shirt) at around noon (12:00-13:00) from March to September, the daily exposure time to reach the end of summer (September) to obtain target serum 25(OH)D concentration would be nine minutes for skin types I-IV (white) and 25 minutes for skin type V (south Asian ethnicity)^{1,12} Deficiency of a nutrient cannot be diagnosed on the basis of dietary assessment alone.¹³ However, there are a number of factors that are putting Client A at risk of being vitamin D deficient:

- Client A is outside in the midday sun in summer at weekends only, therefore reducing his sun exposure. 2015 summer in Wales had an increase rainfall than normal.¹⁴
- Client A wears factor 30 sunscreen for the majority of the time, which reduces cutaneous vitamin D production in the body.
- Client A is also not that keen on fish and doesn't have fish regularly in his diet.
- Client A is of Asian background, therefore his skin requires more time in the sun compared to skin type I-IV.
- Studies on intakes suggest an increased risk of vitamin D deficiency in all ages and sex groups¹⁵ and there was a prevalence of vitamin D deficiency amongst adults in Europe ranging between 2-30% of the adult population.¹⁶

Bar Chart 1: Macro and micronutrients percentage obtained of DRVs for Client A



3. Plan nutrition and dietetic intervention

Once analysed, I met with client A for an hour-long consultation. Based on the findings of the dietary analysis, the following was discussed:

- **Increase CHO as the % of kcals coming from carbohydrate was below the recommended 55-70%.**
Extra portions of porridge at breakfast, increase portions of pasta and rice with his meals. Encouraged to monitor weight weekly to ensure weight remains stable.
- **Reduce fat intake to reduce to <35% of his total kcals.**
Client A's intake of natural yoghurt was not low fat and a large proportion of his saturated fat came from this and hard cheese. Advised to change to low fat yoghurt and taught how to look at labels more clearly, looking at fats in relation to heart health.
- **Protein intake to increase from providing 12% of total kcals to 15%.**
Portions of protein rich foods recommended increasing at meal times. DOMS (delayed onset muscle soreness) discussed, as around 15-25gm of protein within an hour after exercise can help with muscle recovery.¹⁷
- **Abstain from alcohol during intensive training**
Alcohol mean intake over the week provided 3% of his total kcals; this was in fact over two days consumed. Alcohol reduces glycogenolysis (glycogen breakdown) in the liver and thus may hamper performance during training and competing.¹⁸
- **Vitamin D increase with fish or take a supplement. Advised to get a blood test**
Increasing fish consumption in Client A's diet will also increase his protein intake, and provide a low fat protein source rather than hard cheese. Encouraged to have salmon or tuna on a sandwich two to three times a week (100gm of tinned salmon can provide nearly 14 micrograms of vitamin D). Client A is not that keen on fish, therefore there was a rationale to recommend a vitamin D tablet daily with a low dose of 5 micrograms (200IU) in the winter months. According to the FSA, this dose is unlikely to cause him any harm.¹⁹ I recommended that he obtain a serum blood test from his GP (25-hydroxy vitamin D) to check his vitamin D status. Note -OTC (over the counter) vitamin D supplements without calcium tend to come in doses of (vitamin D3) 1000iu 25 micrograms. Advised Client A to have a quarter tablet daily from December to March.
- **Zinc**
Zinc is essential for metabolism of proteins, carbohydrates and lipids. Zinc is found in meat and shellfish; intake can be increased with increasing fish consumption as above and eating red meat once a week.
- **Selenium**
Selenium acts as an antioxidant, protecting the body against oxidative damage. Selenium rich sources include nuts, meat, shellfish, dairy and cereal. I suggested nuts as a snack which will increase this mineral, as well as provide protein and monounsaturated fats. Nine whole brazil nuts will provide his daily RNI of selenium.
- **Potassium**
Potassium in the body is essential for physiology of nerves and muscles and acid base regulation of cells. Potassium deficiency arising from inadequate dietary intake is extremely unlikely. Small amounts of potassium are lost from sweating during exercise, but not enough to have an impact on a well-nourished and healthy adult. Explained to Client A that not obtaining the RNI was not a cause for concern.
- **Sarcopenia**
Some loss of muscle mass is inevitable and is a consequence of aging, skeletal muscle mass declines by 0.5-1% per year once past 40 years of age. The importance of strength training and protein intake was emphasised given Client A's age.²⁰
- **Caffeine as an ergogenic aid**
Client A regularly has a mug of coffee every morning, two mugs at the weekend. Studies have shown that caffeine can have an ergogenic effect on endurance performance, only in people who are not accustomed to caffeine. The athlete must abstain from caffeine for a minimum of seven days before a race, then consume around 3mg per kg (234mg) or a dose of 250mg, taken pre-race or at the end of the race which can improve endurance and performance.²¹ Client A informed me that he is very sensitive to the effects of caffeine, therefore encouraged to trial the above in training first and not during a competitive run. Suggested to abstain as above and then have a coffee before the run (40-163mg), or trial caffeine in gel form towards the end of his run (<100mg).
- **Pre race and race day nutrition discussed briefly**
Reduction of fibre one to two days before run to help with reducing GIT disturbances. Timings were revisited according to the ISSN recommendations²² and practical recommendations.²³

4. Implement nutrition and dietetic intervention

As discussed in the consultation, using Client A's current weekly dietary intake, examples of his new daily meal plans were provided, which met the recommendations. Extra literature was supplied, i.e. portion sizes, protein containing foods, labelling information.

5. Monitor and review

As discussed in the consultation, using Client A's current weekly dietary intake, examples of his new daily meal plans were provided, which met the recommendations. Extra literature was supplied, i.e. portion sizes, protein containing foods, labelling information.

6. Evaluation

"Claire has provided me with nutrition advice in the past, particularly regarding carbohydrate snacks and timings with my running. This advice actually helped in races and I felt that I ran better than before and recovered better with my energy levels, so I trust her advice as it has proved useful in competition.

"I wanted to have a full dietary analysis to see how my general diet was and I am glad I did. I hadn't realised I needed more carbohydrate and less fat and I wasn't having the proportion of fats correctly to help prevent heart problems later on in life. My vitamin and mineral results are mostly meeting the required levels, apart from vitamin D, as I have never really taken to eating fish! Claire sold it to me well and I am going to try with having salmon or tuna weekly and, if not, then the vitamin D supplements are there for me to have over the winter months. I am pleased Claire mentioned the protein timings as, again, this will help me with recovery and I was surprised at the muscle mass loss, so I will certainly be keeping up my strength training. I usually do stop my alcohol a month before the race, as I personally can feel a negative effect the next day after having one or two drinks.

Before my next race in June I will ask Claire to analyse my weekly diet again just to see if my diet is now meeting all requirements and have a recap for race day nutrition with food and fluid."



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