AIS SPORTS SUPPLEMENT FRAMEWORK
N-ACETYL CYSTEINE (NAC)

What is it?

N-Acetylcysteine (NAC) is an amino acid and powerful antioxidant. It is a thiol containing compound that acts to minimise exercise-induced oxidative stress through its actions as a cysteine donor in the maintenance of glutathione homeostasis and via direct scavenging of reactive oxygen species. There are two ways in which NAC supplementation may support athlete performance, as described below:

1. NAC as an ergogenic aid to improve high intensity and repeat sprint performance
   - An accumulation of oxidants can interfere with skeletal muscle contraction[1]
   - There is evidence suggesting that oral NAC supplementation may help to scavenge or 'buffer' oxidants and enable muscle contraction to continue during intense exercise[2-4]
2. NAC to reduce exercise-induced inflammation
   - NAC has been shown to support athlete health during periods of intensified training[2] and tournaments[3]
   - Promotes the up-regulation of anti-inflammatory cytokines and minimises skeletal muscle injury following fatiguing contractile activity[5]

What does it look like?

> NAC is available in a capsule or powder form but no batched product is currently available in Australia

How and when do I use it?

> Please refer to Table 1 for suggested supplementation protocols for the different situations that NAC can be used.

> Anecdotally, NAC is best taken with food to minimise risk of gastrointestinal distress.

Table 1: NAC supplementation protocols

Target event or training	Dose	Protocol	Further information
Repeat high intensity efforts/ intensified training period or tournament	1200mg	Begin supplementation 4 days prior to competition. Additional dose 2h prior to event.	Consider a dose relative to body weight of 70mg/kg for athletes that are below 50kg or above 80kg. Use of NAC for prolonged periods (> 1 month) is not recommended.
Ergogenic aid	1200mg	Chronic loading period for 4 days prior to competition. Additional dose 2h prior to event.	Consider a dose relative to body weight of 70mg/kg for athletes that are below 50kg or above 80kg.
Minimise exercise-induced inflammation	1200mg	Begin supplementation 4 days prior to the intensified training period or tournament. Take daily.	Use of NAC for prolonged periods (> 1 month) is not recommended.

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Are there any concerns or considerations?

Current use of antioxidant supplements

Mega dosing with exogenous antioxidants can potentially inhibit adaptations to exercise.[6] It is important to establish an athlete's current use of antioxidant supplements and consider ceasing when supplementing with NAC for prolonged periods (i.e., during training camps).

Side effects of NAC

Several unwanted side effects have been reported with the use of NAC. It is recommended that when using NAC, athletes are educated on the potential side effects and complete the questionnaire below daily to track and manage any occurrences (Figure 1). If side effects do occur, quercetin may be used as an effective alternative during periods of intensified training or altitude camps. However, other ergogenic aids (i.e., bicarbonate, caffeine) should be considered if NAC is being used for acute performance benefits.

Figure 1: N-Acetyl Cysteine Health Questionnaire

Please grade any reactions that you experience following consumption of the supplement.

Mark only one square.

	None	Mild	Moderate	Severe
Upset stomach	☐	☐	☐	☐
Nausea	☐	☐	☐	☐
Stomach or Intestinal gas	☐	☐	☐	☐
Metallic taste	☐	☐	☐	☐
Light-headedness	☐	☐	☐	☐
Redness of the eye, face or hand	☐	☐	☐	☐
Welts	☐	☐	☐	☐
Other (describe)	☐	☐	☐	☐

Habitual use is not recommended

NAC is not recommended for habitual use. Rather, an increased dietary intake of antioxidant rich foods should be used to improve the oxidant-antioxidant balance in athletes.

Where can I find more information?

Supplement safety information and batch tested product list

Supplements in sport | Sport Integrity Australia

References

1. Cobley, J. N., McGlory, C., Morton, J. P., & Close, G. L. (2011). N-Acetylcysteine Attenuates Fatigue Following Repeated-Bouts of Intermittent Exercise: Practical Implications for Tournament Situations. Int J Sport Nutr Exerc Metab.
2. Merry, T. L., & Ristow, M. (2016). Do antioxidant supplements interfere with skeletal muscle adaptation to exercise training? J Physiol, 594(18), 5135-5147.
3. Pinheiro, C. H., Vitzel, K. F., & Curi, R. (2012). Effect of N-acetylcysteine on markers of skeletal muscle injury after fatiguing contractile activity. Scand J Med Sci Sports, 22(1), 24-33.
4. Reid, M. B., Stokic, D. S., Koch, S. M., Khawli, F. A., & Leis, A. A. (1994). N-acetylcysteine inhibits muscle fatigue in humans. The Journal of Clinical Investigation, 94(6), 2468-2474.
5. Rhodes, K. M., Baker, D. F., Smith, B. T., & Braakhuis, A. J. (2019). Acute Effect of Oral N-Acetylcysteine on Muscle Soreness and Exercise Performance in Semi-Elite Rugby Players. J Diet Suppl, 16(4), 443-453.
6. Slattery, K. M., Dascombe, B., Wallace, L. K., Bentley, D. J., & Coutts, A. J. (2014). Effect of N-acetylcysteine on cycling performance after intensified training. Med Sci Sports Exerc, 46(6), 1114-1123.

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The Australian Institute of Sport (AIS) Supplement Framework is an initiative of the Australian High Performance Sport System. The AIS acknowledges the support of members of the National Institute Network (NIN) and National Sporting Organisations (NSO) and their staff in delivering content expertise. This information is intended to help athletes, coaches and scientists make evidence-based decisions about the use of supplements and sports foods. Before engaging in supplement use, we recommend that each individual refer to the specific supplement policies of their sporting organisation, sports institute or parent body, and seek appropriate professional advice from an accredited sports dietitian (**www.sportsdietitians.com.au**).

Athletes should be aware that the use of supplements may have doping implications. Athletes are reminded that they are responsible for all substances that enter their body under the 'strict liability' rules of the World Anti-Doping Code. Some supplements are riskier than others. The Sport Integrity Australia (SIA) app is a useful resource to help mitigate the risk of inadvertent doping by helping to identify supplements that have been batch-tested. The SIA App provides a list of more than 11,000 batch-tested products. We recommend that all athletes consult the educational resources of SIA regarding the risks associated with supplements and sports foods.. While batch-tested products have the lowest risk of a product containing prohibited substances, they cannot offer you a guarantee that they are not contaminated (**www.sportintegrity.gov.au/what-we-do/supplements-sport**).

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