Journal of Physical Education and Sport ® (JPES), 17(4), Art 307, pp. 2669 - 2673, 2017
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Effect of Paracetamol and Acetylsalicylic Acid intake on short term anaerobic performance

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Published online: December 30, 2017
(Accepted for publication December 22, 2017
DOI:10.7752/jpes.2017.04307

Abstract
Pain reduction can be a significant factor favourably influencing sporting performance. The article is principally focused on evaluating the effects of a combination of analgesics, namely paracetamol and acetylsalicylic acid, on maximum performance and on the perception of load intensity. In a set of healthy athletes (n = 16, mean age = 32.6), who underwent two standardized Wingate Anaerobic tests with and without the indication of the selected analgesics, we ascertained no significant differences in any of the observed parameters of anaerobic performance nor in any other data observed.
Keywords: maximum anaerobic performance, paracetamol, ASA, Wingate test, pain perception, intensity score scale

Introduction

It can be assumed that the implementation of maximum sporting performance is impacted by a number of factors. One of the frequently "utilized" procedures is the attempt to reduce perceived pain, which can limit sport performance (e.g. Holgado et al., 2017).

This has long been known, and this is why some analgesic drugs, such as caffeine or amphetamines, are used by numerous athletes at various stages of their training and competition loads (e.g. Hudson et al. 2008; Motl et al. 2006; Tscholl et al., 2010). These individuals expect that the reduction of perceived pain will be one of the decisive factors favourably impacting their sporting performance. Currently, substances with a very high analgesic effect; (narcotics such as buprenorphine, morphine, diamorphine, methadone, etc.) have already been placed on a list of substances prohibited in sport (World Anti-Doping Agency, 2017). However, there are other "permitted" substances commonly used in the sporting community which also have a relatively strong analgesic effect and about which there is a lack of required information concerning their impact on sporting performance. These substances include paracetamol (acetaminophen). Chemically, this substance can be placed in the group of aniline derivatives. Its advantage is the relative safety of the commonly used dose of 500 mg in the treatment of mild to moderate pain (Kršiak, 2011, Kršiak et al, 2010). Paracetamol works by influencing the activity of cyclooxygenase (COX, enzyme responsible for the synthesis of algesic prostaglandins) in the brain (Boutaud et al. 2002, Bertolini et al. 2006). Currently, it is generally accepted that it inhibits COX-1 and COX-2 through metabolism by the peroxidase function of these isoenzymes. This results in inhibition of phenoxyl radical formation from a critical tyrosine residue essential for the cyclooxygenase activity of COX-1 and COX-2 and prostaglandin (PG) synthesis (Graham et al., 2013).

There are studies attempting which attempt to evaluate the impact of this substance on sporting performance. For instance, Park et al. (2016) confirms the reduction of the perceived sense of pain during load implementation by 8-15%. Foster et al. (2014) demonstrated that paracetamol may have improved performance through the reduction of pain for a given work rate, and another study also shows a significant increase in the observed values of maximum performance (Strava & Rusu, 2015). Some studies, however, have not found any significant differences in the evaluated peak power output or perceived pain (Delextrat et al., 2015, Foster et al., 2014, Mauger et al., 2010). For sporting activity in the conditions of higher ambient temperatures, its thermoregulatory effect is also interesting. (Burtscher et al., 2013, Mauger et al., 2014). All studies, however, assess the effect upon administering relatively high doses of paracetamol (1000 mg and more) and such a quantity has been shown to have a relatively negative impact on the health of the organism, including liver damage (Hodis, 2015, Blieden et al., 2014).

Our research aim was to find whether paracetamol can influence anaerobic load if its effect (in the dose of 500 mg, considered as "still acceptable for health") is supported by another substance. In this instance, we used the acetylsalicylic acid (ASA), which is highly likely to increase its analgesic effect (Goldstein et al., 2014; Kršiak, 2011).

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Material & methods

The subjects observed (n=16) underwent an anaerobic testing after previous instruction and repeated trials. Oral administration of a fixed combination of acetaminophen 500 mg, acetylsalicylic acid 500 mg and a placebo was carried out each time in the same manner. A properly mixed substance for the acute effect, in a larger amount of sweetened liquid (5 dcl), was administered 40 minutes before the start of the test. Those examined completed two standard Wingate 30-s anaerobic tests in two weeks. Each test was preceded by a 4 - 5 minute warm-up on a bicycle ergometer without load, with three freely inserted sprints and the stretching of targeted muscle groups. Automatic work load activation was set up upon reaching a speed of 90 rpm on a Monark 894E peak bike ergometer. For each Wingate Anaerobic Test we used a relatively high resistance load of 0.106 $W \cdot kg^{-1}$ for men and 0.086 $W \cdot kg^{-1}$ for women (Suchý et al., 2010). The load during the test was selected with respect to the physical condition of the group of athletes (Heller, 2005). The respondents were instructed on no strategy of distribution of forces during the performance. In both load tests, we tried to provide motivation and create a competitive atmosphere to achieve the best possible performance in the test (Karaba-Jakovljievič et al., 2007). Immediately after the performance, the respondents evaluated the degree of pain according to the Cook pain scale from 0 to 10 (Keefe et al., 1984), and the degree of intensity according to the Borg intensity score scale from 6 to 20 (Borg, 1998). The research is carried out by the Ethics committee under the number 1.2014.16.

Results

The sample included 16 healthy athletes; 14 men aged 33.4±6.9 and 2 women aged 26.4±0.2. The average weight was 82.1±10.8 kg for the men and 65.5±3.5 for the women. The average height was 182.2±7.7 cm, for the men and 167.5±2.5 cm for the women and the average BMI was calculated to be 24.5±2.5. The statistical evaluation was supported by the Wilcoxon Matched Pairs Test to express the significance of the differences in both tests (Tab. 1). No statistically significant differences in the maximum performance or other parameters were ascertained.

Table 1. Average values of selected Wingate test parameters /mean± SD/

	P_{max} [$W.kg^{-1}$]	P_{max}5s [$W.kg^{-1}$]	P_{min} 5s [$W.kg^{-1}$]	Power drop [%]	Work done [kJ]	Cook	Borg
P	17.5±3.0	14.7±2.7	8.3±1.9	43.4±10.2	44.4±13.1	5.8±2.2	15.9±2.4
C	17.4±3.0	15.0±2.8	8.5±1.9	43.0±8.0	47.0±14.5	5.6±2.2	16.5±1.9
P-level	0.876723	0.408050	0.087945	0.876723	0.133740	0.656645	0.306564

Note: P_{max} [$W.kg^{-1}$]= Peak Power, maximum Power; P_{max} 5s [$W.kg^{-1}$]= maximum power, average from the best 5s; P_{min} 5s [$W.kg^{-1}$]= Minimum Power, average from the worst 5s; PD [%]= Power Drop; Work done [kJ]= whole work done during the 30s; Cook= pain score scale; Borg= intensity score scale; P= test realized after taking paracetamol 500 mg; C= Control test; P-level= statistically significant difference value

Individual maximum values (peak power value) of both anaerobic tests are shown in Figure 1. The results of pain perception under load by individuals are shown in Figure 2. and the results of borg intensity score scale in Figure 3.

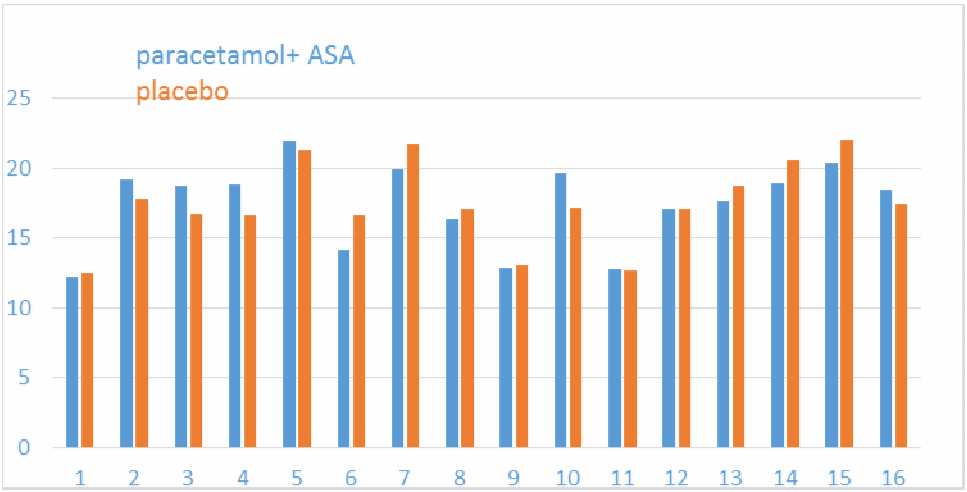

Figure 1. Individual peak power values in two Wingate Anaerobic tests with and without paracetamol and ASA intake

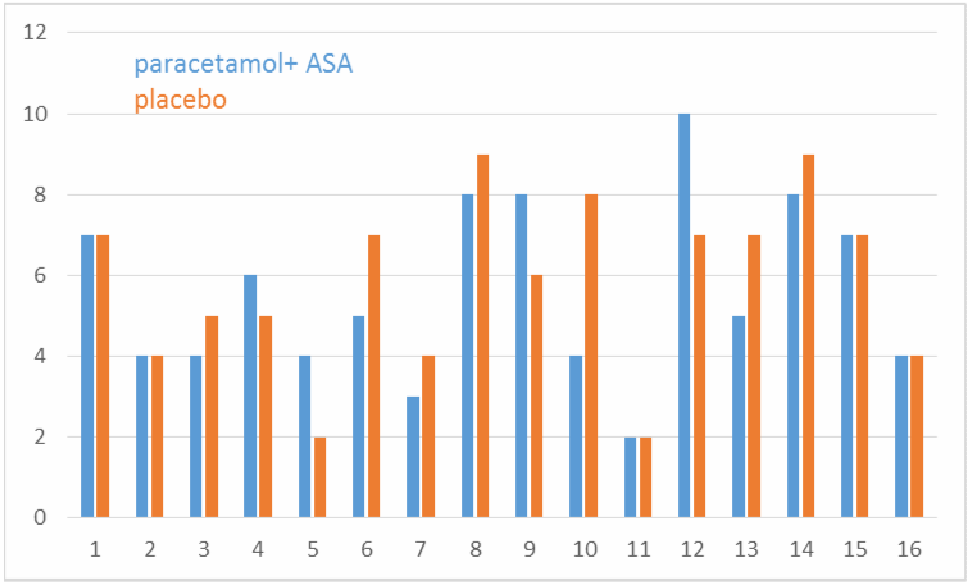

Figure 2. Individual pain effects values according to the Cook pain scale in two Wingate Anaerobic tests with and without paracetamol intake

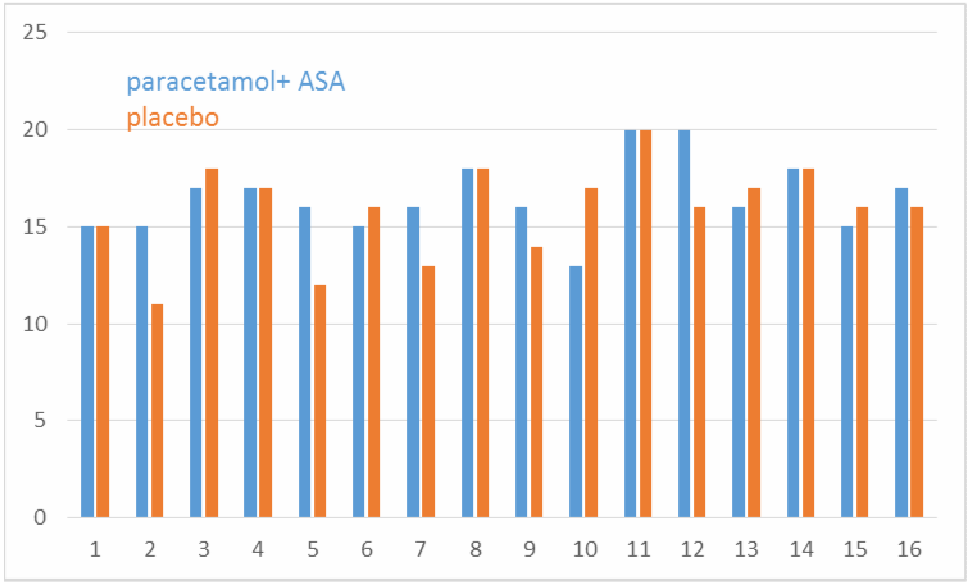

Figure 3. Individual intensity effects values according to the Borg intensity score scale in two Wingate Anaerobic tests with and without paracetamol intake

Discussion

Paracetamol is a substance with an analgesic effect and is currently not forbidden by the World Anti-Doping Agency and can be used by some athletes to improve their load (Holgado et al., 2017). Its effects, which are likely to impact sporting performance, especially by suppressing the perceived pain, mean that the results from numerous studies evaluating these effects are followed with great interest by the entire sports community. Some studies have demonstrated its favourable impact on performance (Park et al., 2016, Strava & Rusu, 2015), while others have not confirmed such an effect (Delextrat et al., 2015, Foster et al., 2014, Mauger et al., 2010). At the same time, it should be remembered that if the studies show improvement of sport performance (Park et al., 2016, Strava & Rusu, 2015), they involve a quantity with adverse effect on the athlete's health (Hodis, 2015, Blieden et al., 2014).

This is why we decided to evaluate the effect of the "medically still acceptable dose" of paracetamol, reinforcing its analgesic effect by adding ASA. Our results, however, did not show any significant difference in the maximum performance or average performance, nor was there ascertained any impact on pain perception and load intensity. Therefore, we can argue that our study tends to agree with other studies (Delextrat et al., 2015, Foster et al., 2014, Mauger et al., 2010), which have have also failed to confirm the ergogenic effect of the paracetamol dose in combination with ASA.

Conclusions

Our results did not show any significantly increased values of either observed speed-force performance, i.e. an average anaerobic performance at 30s, power drop (fatigue index), nor intensity or pain perception in the Wingate Anaerobic test. Therefore, we can corroborate these results. Paracetamol in the usual dose, supported by an increased analgesic effect from acetylsalicylic acid, does not deliver any ergogenic effect for anaerobic performance, nor does it improve the feeling of pain and intensity during anaerobic load subjectively perceived by the athlete.

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