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Observational study

A longitudinal exploration of pain tolerance and participation in contact sports

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HIGHLIGHTS

- Pain tolerance and perception is measured over a contact sport athletic season.
- Participating athletes were more pain tolerant than non-participating athletes at 8 months.
- Athletes who participate in contact sports find pain less bothersome over a season.
- Non-participating contact athletes become less pain tolerant over a season.

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ABSTRACT

Background/aims: Athletes who choose to engage in contact sports do so with the knowledge that participation will bring pain in the form of contact with others, injury, and from exertion. Whilst athletes who play contact sports have been shown to have higher pain tolerance than those who do not, it is unclear whether this is a result of habituation over time, or as a result of individual differences at the outset. The aim was to compare pain responses over an athletic season in athletes who participated in contact sport and those who disengaged from it.

Methods: One hundred and two new contact athletes completed measures of cold and ischaemic pain tolerance, perceived pain intensity, pain bothersomeness, pain coping styles and attendance at the start, middle (4 months) and end (8 months) of their season. The athletes were drawn from martial arts, rugby and American football. Cluster analysis placed 47 athletes into a participating category and 55 into a non-participating cluster.

Results: Participating athletes had higher ischaemic pain tolerance at the start ($r = 0.27$, $p = 0.05$), middle ($r = 0.41$, $p < 0.0001$) and end of the season ($r = 0.57$, $p < 0.0001$) compared to non-participating athletes. In addition participating athletes were more tolerant to cold pain at the end of the season ($r = 0.39$, $p < 0.0001$), compared to non-participating athletes. Participating athletes also exhibited higher direct coping, catastrophized less about injury pain and also found contact pain to be less bothersome physically and psychologically compared to non-participating athletes. Participating athletes were more tolerant of ischaemic pain at the end of the season compared to the start ($r = 0.28$, $p = 0.04$). Conversely non-participating athletes became significantly less tolerant to both pain stimuli by the end of the season (cold pressor; $r = 0.54$, $p < 0.0001$; ischaemia; $r = 0.43$, $p = 0.006$). Pain intensity as measured by a visual analogue scale did not change over the season for both groups.

Conclusions: Those who cease participation in contact sports become less pain tolerant of experimental pain, possibly a result of catastrophizing. The results suggest that athletes who commit to contact sports find pain less bothersome over time, possibly as a result of experience and learning to cope with pain. Athletes who continue to participate in contact sports have a higher pain tolerance, report less bothersomeness and have higher direct coping than those who drop out. In addition, tolerance to ischaemic pain increased over the season for participating athletes.

Implications: Having a low pain tolerance should not prevent athletes from taking part in contact sports, as pain becomes less bothersome in athletes who adhere to such activities. Participating in contact sports may result in maintained cold pain tolerance, increased ischaemic pain tolerance, reduced catastrophizing and better coping skills. Coaches can therefore work with athletes to develop pain coping strategies to aid adherence to contact sports.

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1. Introduction

There is evidence that athletes and non-athletes differ in their responses to pain [1,2]. A meta-analysis of 15 studies found that athletes have a higher pain tolerance than non-athletes [3]. Athletes who participate in high contact sports have higher pain tolerance and report less pain intensity than athletes who play non-contact or low contact sports [4–6]; Athletes who engage in endurance sports also exhibit higher pain tolerance than others [7], and highly trained swimmers have higher pain tolerance than recreational athletes [8].

There are many plausible reasons for these differences, including alterations to endogenous inhibitory processes [3], individual differences such as personality [9], or learning to cope with pain [10]. It has been postulated that engaging in regular, vigorous physical activity may alter pain perception and tolerance [3,7,11]. Such activity may improve or alter endogenous inhibitory processes, thereby reducing pain. Thus, endurance athletes may perceive and process pain differently to non-athletes as a result of repeated exposure to exhausting training [7]. Further studies have suggested that participation in high intensity training along with personality traits and perceptions regarding pain control may mediate pain responses [12]. It has also been postulated that individuals learn to tolerate pain through the use of coping strategies [12], or through habituation [13], resilience [14] or experience [5]. In laboratory studies repeated exposure to pain has resulted in task interference habituation, indicating that in controlled environments, the recurrent experience of pain may reduce its intensity and its detrimental effects on performance [13]. It has also been suggested that pain intensity may decrease as a result of experience, as illustrated in studies of battlefield pain [15] and labour pain [16]. There is evidence however that exposure to pain may result in sensitisation due to pain-related anxiety [17].

There has been little exploration of adherence to painful contact sports; however injury rehabilitation research has shown that individuals with high pain tolerance adhere better to treatment programmes [18]. Exercise adherence literature suggests that approximately 50% of people who begin an exercise programme drop out [19]. The intensity of activity, injury risk and exercise mode predict adherence [19]. Little research has examined the determinants of adoption and adherence of these different characteristics in contact sport.

This study is the first to explore participation in contact sports whilst examining differences in pain responses. Changes in pain reporting over time has been measured in experimental settings using healthy non-athletes [e.g. 20], however many studies have only taken measurements over a few days or hours [21] and none have examined athletes. We examined participation in contact sports over an athletic season alongside measures of cold and ischaemic pain tolerance, pain bothersomeness and pain coping styles; non athletes were not included as previous work has already established that they differ from athletes in their response to pain. Further, the study aimed to test the competing hypotheses that contact athletes are more pain tolerant at the outset of playing or that pain tolerance increases in participating contact athletes during their first season.

2. Materials and method

2.1. Hypotheses

In order to test the following hypotheses, data were collected at three points over an eight month period. Participating contact athletes were compared with those who stopped participating, following cluster analysis.

H_1. Cold and ischaemic pain tolerance would differ at each point in the season according to whether athletes participated in the sport or stopped participating. It was hypothesised that participating contact athletes would increase pain tolerance over the season.

H_2. Pain intensity ratings would differ at each point in the season according to whether athletes participated or stopped participating in the sport. It was hypothesised that pain intensity ratings would reduce over the season for participating athletes.

H_3. Bothersomeness of pain would differ at each point in the season according to whether athletes participated or stopped participating in the sport. It was hypothesised that bothersomeness would reduce over the season for participating athletes.

H_4. Participating athletes would demonstrate a higher direct coping style than non-participating athletes.

2.2. Participants

A total of 102 pain free student athletes, 47 males (mean age = 23.6 years, SD = 6.0 years) and 55 females (mean age = 20.5 years, SD = 3.6 years), who were new to both post-compulsory education and voluntary contact sports were recruited via university notice boards, direct contact with local clubs and through social media. The participants had all recently begun taking part voluntarily in a contact sport (rugby, $n = 62$; American football, $n = 15$; mixed martial arts (MMA), $n = 11$; and kickboxing, $n = 14$). Participants were classed as new to contact sports if they previously had no experience of engaging in sports where contact is allowed within the rules. Sample sizes were calculated based on prospective estimates of power and effect size figures to achieve an acceptable power level of 0.8 and a large effect size of 0.138 [22]. Ethical approval for the study was granted by the University Research Ethics Committee.

2.3. Materials

2.3.1. Demographic questionnaire

Participants were asked to state the number of injuries they had suffered, previous sports played as well as age and gender. The participants were also asked three questions about their feelings regarding beginning their new sport, which were responded to on a five-point Likert scale: how much they were looking forward to the sport (1 = *not at all*, 5 = *extremely*); how much they thought they would enjoy the sport (1 = *not at all*, 5 = *extremely*); and how they thought they would feel about any pain experienced in the sport (1 = *dislike it very much*, 5 = *like it very much*).

2.3.2. Sports Inventory for Pain (SIP15) [23]

Participants completed three adapted versions of the SIP15 questionnaire that were altered to account for three different pain types; contact pain, exertion pain and injury related pain. The wording in the questionnaire was adapted to reflect the pain types; for example, where the SIP15 states "I see pain as a challenge and I don't let it bother me", the word "contact", "injury" or "exertion" was inserted before the word "pain" to allow participants to reflect on that pain type specifically, a definition each type of pain was provided.

The SIP15 was developed from the original Sports Inventory for Pain [24] and is a 15 item inventory that contains three subscales – Direct Coping, Somatic Awareness and Catastrophizing. Direct Coping (through action) is a positive coping style in relation to pain and assesses the extent to which someone uses direct coping strategies to deal with pain. People who score high on this scale tend to approach pain positively and are prepared to endure it [24]. The Catastrophizing scale measures whether individuals