Training Alone, Driven Together: The Impact of Social Identity on Physical Effort in Endurance Tasks

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Running Head: Social Identity and Perceived Exertion

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Abstract

Achieving and sustaining high performance in elite sport requires athletes to endure extreme physical and psychological demands. While collective identity is often assumed to enhance commitment to these efforts, many elite athletes must train autonomously, raising questions about the role of social identification in sustaining effort when training alone. This study investigates how social identity influences physical engagement in endurance tasks performed in isolation, examining whether identification with a team enhances perseverance or if individual goal pursuit fosters greater effort. Fifty-four elite youth athletes (36 males; age: 15.7 yr ± 1.1) from team-based sports (handball, basketball, volleyball, and rugby) performed a cycling time-to-exhaustion test at 80% of their maximal aerobic power under two conditions: one emphasizing personal achievement and another emphasizing team success. Results revealed that athletes persisted longer in the personal identity condition compared to the collective identity condition, with no significant differences in perceived exertion, muscle pain, or time perception. However, athletes in the collective condition reported higher motivation and greater expectations of team success, despite performing less. These findings challenge conventional perspectives on social identity in sport, suggesting that while identification with a team may boost resilience and motivation, it does not necessarily enhance physical endurance when training alone. Instead, individual goal framing appears to optimize sustained effort in autonomous settings. This underscores the context-dependent nature of social identity effects on performance, emphasizing the need for coaches to differentiate when reinforcing personal identity fosters greater engagement and when strengthening team identity serves to stabilize collective dynamics.

Keywords: Physical performance, Team sports, Autonomous training, Effort Sustainability, Goals

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Achieving and sustaining high performance in elite sport necessitates numerous physiological and psychological sacrifices, with physical exertion being one of the most demanding (Burlot et al., 2018). Elite athletes are subjected to intense training regimens, encompassing high-intensity trainings, exhaustive endurance drills, repeated high-impact matches, and heavy-load strength workouts, all of which push their bodies to absolute physiological and psychological limits in pursuit of competitive excellence. As part of the scientific support programme for France team-based federations in preparation for the Paris 2024 Olympic Games, this study investigates the uncompromising physical demands associated with elite athletic preparation. While the social context is widely acknowledged for its beneficial effects in team sports (Haslam et al., 2020), this study specifically examines how the absence of others– like in autonomous training–influences the ability to sustain effort and perseverance in the pursuit of peak performance.

Indeed, one of the foremost challenges for head coaches and strength and conditioning experts is thus to manage athletes' physical engagement, striking a balance between optimising training intensity and preventing maladaptive overexertion, which may result in technical inefficiencies, tactical indiscipline (Campo, Champely, Lane, et al., 2019), or heightened health risks, including musculoskeletal injuries, cardiovascular complications, or cumulative fatigue syndromes (Meeusen et al., 2013). Also, in elite team sports, structured preparation periods tend to reduce in time, driven by professional club commitments, but also concerns regarding excessive physical and psychological load imposed to players during a season. As a result, players are often compelled to train in autonomy, in the absence of teammates and coaching staff (Baker et al., 2003; Helsen et al., 1998; Mellalieu et al., 2023). Therefore, while it is well recognized that practicing together positively influences athletes’ involvement

(Haslam et al., 2020), this context raises a fundamental question: is a player's identification with the team's collective objective sufficient to sustain full engagement in physically demanding tasks, particularly in situations where training autonomously?

This question is especially pertinent in the context of team selection processes, wherein athletes are often required to sustain high-intensity training under conditions of uncertainty, without knowing whether they will ultimately be included in the final competitive roster. In elite team sports, the emphasis on individual selection as the foundation for team formation inherently places personal performance at the forefront. This individualised selection process, which determines an athlete's inclusion in the team, is further reinforced by external factors such as financial incentives, media exposure, and personal branding. As a result, the collective dimension of sport can be overshadowed, shifting athletes' focus toward self-promotion and personal achievement rather than team objectives (Tamminen et al., 2016). Thus, while these physical demands are undeniable, an athlete's willingness to endure such constraints necessarily raises the question of players' motivations. This underscores the role of social cognitions—shaped by the dialectical interplay between personal and collective stakes—in influencing athletes' behaviours (Campo, Champely, Louvet, et al., 2019; Rees et al., 2015; Tamminen et al., 2016). In particular, these cognitions foster engagement and perseverance, both essential for maintaining individual commitment and enhancing team-oriented performance. A substitute player, for instance, may simultaneously take pride in the team's success while feeling frustration or resentment due to limited playing time. Despite this ambivalence, a strong sense of social identification can foster continued engagement and perseverance, as the player remains committed to the collective goal, internalizing team norms that encourage sustained effort and contribution, even in a supporting role. Conversely, a weaker identification with the group may lead to disengagement, reduced motivation, and a diminished willingness to exert effort when opportunities arise.

This dynamic highlights the relevance of the Social Identity Approach (SIA; Haslam, 2004) in understanding motivation in elite sport (Greenaway et al., 2020). According to the SIA, the self does not operate at a single, fixed level of abstraction. Rather, individuals navigate between a personal self—experienced as a unique individual—and a social self—defined through group membership. The salience of either level is shaped by the perceived, anticipated, or imagined presence of others who are seen as belonging to a different group. Social identity is then defined as "that part of an individual's self-concept which derives from his/her knowledge of his/her membership of a social group (or groups) together with the value and emotional significance attached to that membership" (Tajfel, 1978, p. 63). In other words, social identity shapes individuals' cognition of reality, partly by influencing both psychosocial processes, such as emotions and motivation, and cognitive mechanisms, including perception, attention, and memory encoding (Molenberghs, 2022). These interactions contribute to interpretative biases that affect how individuals process and respond to their social environment (Tajfel & Turner, 1979).

Thus, from a psychosocial perspective, identity-based motivation (Oyserman et al., 2017) offers a relevant framework to examine how social identification influences physical engagement in sport. Indeed, when athletes strongly identify with their team, effort is not merely an individual act but a contribution to a collective goal, making physical demands and sacrifices more acceptable—even necessary—to uphold the team's standards. The way effort is framed within a team—whether as a marker of belonging, a demonstration of commitment, or an expected norm—can significantly shape an athlete's willingness to sustain high engagement (e.g., De Cuyper et al., 2016). For instance, social identity has been shown as predicting commitment and effort in youth sport explaining that, as a proportion of an individuals' identity is represented by the group, athletes might have demonstrated increased effort to more favourably represent the team (Forsyth, 2014).

From a cognitive perspective, perseverance in physical effort is governed by interdependent regulatory processes, including time perception and the appraisal of exertion-induced pain. According to the teleoanticipation model (Ulmer, 1996), individuals dynamically adjust their effort based on anticipated exertion costs, increasing intensity as a goal nears while modulating pacing to prevent premature exhaustion (Edwards & Polman, 2013; Smits et al., 2014). However, time perception alone does not fully account for endurance, as perceived effort is a central determinant of persistence. Disengagement occurs when exertion exceeds an individual's subjective threshold, which is not merely dictated by physiological fatigue but is actively modulated by cognitive appraisal of discomfort (Hutchinson, 2021; Marcora, 2010).

While inherently individual, cognitive mechanisms are also deeply embedded within social contexts. Therefore, social factors play a critical role in shaping effort perception and endurance: social support has been shown to mitigate perceived exertion without altering physiological workload (Davis & Cohen, 2018), social isolation expands perceived time duration (Cravo et al., 2022), and social interactions influence pain perception (Sharvit & Schweinhardt, 2022). These findings align with the broader perspective that the human brain is inherently social, with cognitive processes fundamentally influenced by group membership (Caporael, 1997; Dunbar, 1998).

Within this framework, social neuroscience has demonstrated that group identification biases perceptual and affective processing, as evidenced by differential responses in facial recognition (van Bavel & Cunningham, 2012), emotion perception (Krautheim et al., 2019), and action observation (Molenberghs, 2013). Notably, strong group identification has been associated with greater pain tolerance (Grünenwald et al., 2023) and prolonged effort under intergroup threat (Giguère & Lalonde, 2009), suggesting a socially mediated resilience mechanism or regulatory processes. Social identity appears thus to be a potential determinant of

endurance in effortful tasks, shaping how individuals process and respond to both internal and external feedback through awareness of belonging to a group.

While the influence of others on physical performance has long been established in the literature on social facilitation and social support, since the very early seminal work by Triplett (1898), the broader role of social cognition in endurance—particularly its influence on mental effort regulation—remains insufficiently understood. Notably, this perspective extends beyond traditional motivation-based models of perseverance, which primarily emphasize goal-directed effort, reward valuation, and self-regulation. Complementarily, it highlights how internalized social belonging and group identification may contribute to endurance through cognitive and physiological mechanisms, even in the absence of direct social interaction. The extent to which social identity alone—independent of immediate social perception—modulates perseverance remains an open question. Investigating this phenomenon offers a compelling avenue for completing existing motivation-centered frameworks by integrating the role of social identity in cognitive and physiological endurance regulation.

Overall, athletes' dedication to physical tasks may be influenced by their perception of pain and effort (Hutchinson, 2021), as well as by the motivation derived from individual or team-based competitive objectives (Campo, Champely, Louvet, et al., 2019; Tamminen et al., 2016). These mechanisms are not purely individual processes; they are also embedded within social identity dynamics, which shape how effort and discomfort are interpreted within a collective framework. While previous research has examined the psychological and physiological determinants of endurance, to the best of our knowledge, no study in sport has explicitly investigated the direct relationship between social identification and physical engagement in a competitive context. Thus, the present work aims to examine the role of social identity in shaping physical engagement, particularly in endurance tasks requiring sustained effort. More specifically, we investigate whether strong identification with a team serves as a

psychological buffer, altering pain perception and perceived effort duration while enhancing willingness and perseverance.

In addition, within the social identity literature, research has extensively examined how athletes with a stronger sense of social identification are more likely to engage in their sport (Slater & Barker, 2019). This relationship is often attributed to the effects of social facilitation and social support, both of which are closely tied to social identity (see Greenaway et al., 2020; Hartley et al., 2020, for discussion). Therefore, our contribution also lies in disentangling this effect from the potential confounding influence of teammates' mere physical presence—a ubiquitous factor in collective training settings—while investigating the extent to which athletes autonomously commit to effortful actions for the benefit of the group, despite the individual strain experienced. Controlling for this variable is important to isolate the specific impact of social identification, as the presence of teammates may introduce multicollinearity, thereby obscuring the distinct contribution of identity-based mechanisms and preventing a precise understanding of the processes underlying engagement in physically demanding training tasks performed in autonomy. Thus, we hypothesize that athletes performing an effortful task alone, when framed as contributing to a collective objective, will exhibit a longer time-to-exhaustion compared to those performing alone for personal achievement, demonstrating the power of social identification in sustaining effort. This effect should be explained, at least in part, by two key mechanisms: (1) an increase in motivation driven by identification with the group, leading to a stronger commitment to the task, and (2) cognitive modulations associated with social identification, altering the perception of effort and exertion. More specifically, we hypothesize that athletes in the collective condition will report a lower perception of pain and a subjective acceleration of time perception compared to those in the personal achievement condition. This effect can be attributed to the cognitive and attentional shifts induced by social identification, which may enhance task engagement and divert focus away

from discomfort and temporal awareness. Furthermore, we propose that social identification will lead to a reduced perception of effort, which in turn will contribute to increased endurance. By fostering a stronger sense of purpose and group cohesion, identification with the collective goal may alleviate the subjective burden of exertion, allowing athletes to sustain effort for longer durations

Materials and Methods

Participants

Fifty-four youth elite athletes (36 males; age: 15.7 yr ± 1.1; height: 180.8 cm ± 10.2; weight: 73.7 kg ± 12) volunteered in the study. None of the participants had any heart problems or chronic diseases or were taking medication at the time of the study. Participants were members of four different youth elite academies of the four main French federations of Olympic teams-based sports, identified here as teams (i.e., handball, basketball, volleyball, rugby). The participants were non-specifically trained in cycling.

Procedure

The study was approved by the local ethic committee (N°IRB00012476-2021-19-03-95) and was in accordance with the principles of the Declaration of Helsinki for human experimentation.

After gaining approval from the ethics review board, we initially contacted the coaches of different sports teams. Following the coach's agreement, the participants were given written instructions describing all procedures related to the study but were naive to the true aims and hypothesis of the study. At the end of the last session, they were debriefed about the fundamental purposes of the study.

The experiment generally lasts two weeks within a team, including three different sessions with a minimum of 48h recovery in between. During the first session, participants were familiarized with the different questionnaires and scales and performed a maximal aerobic

power (MAP) test. The second and third visits were the experimental sessions. In these sessions, participants completed a time to exhaustion at 80% of MAP, with either the individual or collective identity positioning in a randomized and counterbalanced order.

Cycling Tasks

Maximal Aerobic Power (MAP). During the first session, an incremental exercise (2 min at 50 W followed by an increase in 50 W every 2 min) was performed until exhaustion [operationally defined as a pedal frequency of less than 60 rpm for more than 5 s despite strong verbal encouragement] on an electromagnetically braked cycle ergometer (Monark LC5). The cycle ergometer was set in hyperbolic mode, allowing the power output to be set independently of pedal frequency over 30–120 rpm. Before the incremental exercise, the position on the cycle ergometer was adjusted for each subject, and settings were recorded so they could be reproduced at each subsequent visit. The mean MAP was 291.04 W ± 51.83 corresponding to 3.98 W/kg ± 0.55 (males = 312.7 W ± 43.9 corresponding to 4.11 W/kg ± 0.54; females = 239.6 ± 28.7 corresponding to 3.67 W/kg ± 0.47).

Time to Exhaustion at 80% MAP. After a 5-min warm-up at 25% of MAP, participants performed a time to exhaustion at 80% MAP during the second and the third sessions. Pedal frequency was freely chosen between 60 and 100 rpm. Time to exhaustion was measured from the start of the rectangular workload until the pedal frequency was less than 60 rpm for more than 5 s. The pedal frequency was the only information displayed to the participants. This information was provided on the Monark LC5 monitor in front of the participant. Participants were not aware of the exercise duration and their heart rates.

Identity Manipulation

The participants were distracted from the true purposes of the study by a cover story conveyed by the experimenters with the help of coaches (Harmon-Jones et al., 2007). To ensure the ecological validity of the results and facilitate the manipulation, the experiments took

place at the players' training structures. Specifically, the experimenters explained to the participants that a national test was organized to select the best teams and players for two national training camps. The experimenters posed as members of the participants' federation's performance support department. One of the two training camps was presented as aiming at developing individual qualities for which only the best players from each team were qualified (i.e., competition between members of the same team to induce a personal identity). The other training camp was presented as aiming at developing collective qualities in which only the best teams were qualified (i.e., competition between the teams to induce a social identity).

To ensure the effect of each experimental condition, according to the social identity precepts, we used several tricks aiming at strengthening or lessening participants' perception about their team membership. First, inspired by Campo, Champely, Louvet et al.'s procedure (2019), in the personal identity condition, the participants were told that individual performances were assessed and that "the 10% of best athletes from the team will be selected for the individual training camp" (i.e., induction of an individual goals in an interpersonal social scene). This information was intended to make personal-level concerns salient (i.e., what is most important for me is to be the best player) and to reduce team identification. In the social identity condition, participants were told that "each player's performance would be added to obtain an overall team performance and only the winning team will be selected for the collective training camp". This induction was intended to make the group-level goal salient (i.e., what is the most important for me is that my team wins), thus participating in increasing group identification.

In addition, to lessen the level of self-abstraction, the participants wrote their first and last names on a label they then fixed on their jersey. In contrast, to reinforce social identification, they had to write the name of their team. Manipulation check and motivation check were administered right before the beginning of the MAP.

Finally, to ensure the stability of the players' identity positioning during the game (Campo et al., 2018), reminders on individual or collective stake were announced to the participants every 180 seconds. Also, during the experiment, the participants saw on a screen in front of them, their own photo of against those of the other members of the team (i.e., personal identity condition), or a photo of the logo of their team against the other teams (fictitiously) in competition (i.e., social identity condition).

Measurements

Manipulation Check and Motivation. The effectiveness of the manipulation was assessed before the beginning of each time to exhaustion task. Participants responded to a bipolar 10 cm Visual Analogue Scale (VAS), anchored at the extremes by "what is the most important for me is to be the best" (at 0 mm) and "what is the most important for me is that my team wins" (at 100 mm). In addition, we also used the the Inclusion of Other in the Self scale (IOS; Aron et al., 1992) to measure the level to which the group was included in the self (Aron et al., 1991). The same use of VAS was conducted for examining motivation (0 mm = "not motivated"; 100 mm = ''extremely motivated"). Participants indicated their answers by putting a vertical line on the VAS, and the measures were reported at the nearest millimetre.

Heart Rate. Heart rate was continuously recorded during exercise using a chest belt and heart rate monitor (Polar RS300; Polar Electro Oy, Kempele, Finland). Data were analyzed offline.

Blood Lactate. Blood lactate concentrations from capillary finger samples (20 µl) were collected and analyzed with a Lactate Scout at the beginning of each session and one minute after the end of the time to exhaustion.

Perception of Effort. Perception of effort, defined as "the conscious sensation of how hard, heavy, and strenuous a physical task is" (Marcora, 2010; Pageaux, 2016), was asked during the time to exhaustion at 80% and MAP test every 90 s with the CR100 scale. Standardized

explanations on how to use the scale were provided to the participants at the beginning of each session.

Muscle Pain. Muscle pain, defined as "the intensity of hurt felt in a muscle" (O'connor & Cook, 1999), was asked during the time to exhaustion at 80% and MAP test every 90 s with the CR100 scale. Participants were asked to report the muscle pain perceived in their legs muscles.

Performance. At the end of the time to exhaustion, the experimenters asked subjects about the time they think they have realized, called "Perceived time". Moreover, a VAS was used by participants to estimate several parameters after the time to exhaustion as "individual performance" and "expectation of success". To evaluate individual performance, the following question was asked to the participants: "What do you think of your individual performance?" (0 mm = "very bad"; 100 mm = ''excellent"). Same procedure was conducted for the expectation of success, with the question: "What are your chances of being selected?" (0 mm = "none"; 100 mm = ''every chance").

Statistical Analysis

Data are reported as mean ± SD. All measured variables were compared between the individual and the collective conditions using T test, as well as between gender (displayed only when there was a significant difference). Aforementioned variables are manipulation check (importance, IOS, motivation), time to exhaustion, rate of perceived exertion, muscle pain, heart rate, blood lactate, perceived time, perceived individual performance and expectation of success. In addition, session order was controlled for.

Results

Manipulation Check

Participants' responses to whether their individual performance or the team's performance was more important revealed a large significant difference in the expected direction

($t(108) = 11.45$, $p < 0.001$), with scores in the social identity condition indicating that team performance was more important ($M_{highID} = 8.48 \pm 2.03$) and scores in the personal identity condition indicating that individual performance was more important ($M_{lowID} = 2.37 \pm 2.87$). The same results were observed for the integration of ingroup in the self ($t(108) = 3.77$, $p < .001$), suggesting that the induction of collective goals reinforces identification with the collective (Personal Identity Condition = 4.37 ± 2.13 vs. Social Identity Condition = 5.94 ± 1.12). Finally, motivation tended to be higher ($t(52) = 1.975$; $p = .054$) for the social identity condition (Personal Identity Condition = 8.0 ± 2.0 vs. Social Identity Condition = 8.3 ± 1.5). Also, statistical analysis showed that males were more motivated than females ($t(58.9) = -2.278$, $p = .026$; females = 7.26 ± 2.17 vs. males = 8.50 ± 1.41).

Time to Exhaustion at 80% MAP

Statistical analysis showed a significant difference between both conditions ($t(49.8) = -3.059$; $p = .004$), suggesting that athletes lasted more time during the personal identity condition (616 s ± 187) in comparison to the social identity condition (568 s ± 170). Moreover, there is also an order session effect ($t(53.4) = -2.695$; $p = .009$), suggesting that subjects lasted more time during the first session (621 s ± 169.9) comparatively to the second session (562.9 s ± 185.3). The rate of perceived exertion (RPE) during the time to exhaustion at 80% increased over time following both sessions. However, no significant differences were observed for mean RPE (Personal Identity Condition = 68.4 ± 15.2 vs. Social Identity Condition = 67.7 ± 15.2) and muscle pain (Personal Identity Condition = 75.8 ± 14.0 vs. Social Identity Condition = 74.8 ± 13.0). Statistical analysis also showed an order session effect ($t(54.8) = -2.369$; $p = .021$), indicating that the first session appeared more difficult than the second session (Session 1 = 69.70 ± 15.34 vs. Session 2 = 66.33 ± 14.82). Results also showed that mean RPE was higher for the females compared to the males ($t(60.4) = -2.468$; $p = .016$; females = 69.92 ± 14.35 vs. males = 63.49 ± 16.11).

No significant difference was observed in heart rate between both conditions ($t(53.8) = 0.963$; $p = .34$), suggesting that athletes were given in a physiologically equivalent way during both sessions. However, an order session effect was also observed ($t(62.7) = -2.04$; $p = .046$), indicating that athletes had a lower heart rate at the end of the second session (Session 1 : End of warm-up = 122.03 ± 11.44 vs. End of time to exhaustion = 185.77 ± 9.92 ; Session 2 : End of warm-up = 121.27 ± 9.31 vs. End of time to exhaustion = 181.16 ± 8.88).

For lactate concentration, no significant difference was observed between both conditions ($t(50) = 0.63$; $p = .532$) nor between sessions order ($t(60.6) = 1.09$; $p = .281$).

Assessment of Performance

No significant result was reported for participants' estimation of the perceived time between both conditions ($t(46.4) = 0.629$; $p = .533$). Concerning the individual performance, statistical analysis showed a tendency effect ($t(50.8) = -1.736$; $p = .089$), suggesting that subjects thought they performed better during the personal identity condition (6.1 ± 2.0) in comparison to the social identity condition (5.6 ± 2.3). However, results showed a significant difference for this parameter between males and females ($t(54.7) = -2.545$; $p = .014$), indicating a lower value for females in comparison to males (females = 4.8 ± 1.7 vs. males = 6.3 ± 2.2). In addition, we observed an order session effect ($t(57.8) = -3.105$; $p = .003$), indicating that subjects thought they performed better during the first session in comparison to the second session (Session 1 = 6.3 ± 1.7 ; Session 2 = 5.4 ± 2.4). For the expectation of success, participants thought they had a significant higher chance of being selected after the social than personal identity condition ($t(53.6) = 3.791$; $p < .001$; Social Identity Condition = 6.6 ± 1.7 vs. Personal Identity Condition = 5.2 ± 2.3).

Discussion

While elite athletes must often train alone intensively to enhance their chances of selection and contribute to team performance, this raises the question of the underlying

mechanisms that enable players to sustain high-intensity training in the absence of a collective support. The present study addresses this issue by examining the role of social identification in shaping physical engagement, particularly in endurance tasks that require sustained effort.

First, the present findings contradict the well-established notion that social identification enhances athletic performance by facilitating effort sustainability. Contrary to our initial hypothesis, participants exhibited superior performance in individual conditions compared to collective ones, with no significant differences in pain perception, perceived effort duration, or overall effort perception.

From a cognitive perspective, sustained physical effort is underpinned by a distributed cortical network encompassing motor regions, the insular cortex, and the prefrontal cortex (PFC). As demonstrated in previous research, motor cortex activity tends to diminish with the accumulation of fatigue, leading to altered signaling in the anterior insula—a key hub for interoceptive processing and the subjective evaluation of effort (Hogan et al., 2020). Subsequent engagement of the PFC is instrumental in integrating this interoceptive feedback to guide executive decisions about effort continuation or withdrawal (Robertson & Marino, 2016).

Our findings align with this model, suggesting that social identity or group membership, in the absence of direct social interaction, does not confer a modulatory benefit on these neurocognitive processes. The superior individual performance observed may reflect more efficient recruitment of cognitive control networks, particularly within the dorsolateral and medial prefrontal regions, when self-regulation is guided by internally generated cues rather than external social signals. In contrast, the collective context may induce a redistribution or partial disengagement of prefrontal resources, potentially compromising the precision of effort-related decision-making. These results underscore the central role of individual interoceptive and executive mechanisms in sustaining effort under conditions of physical fatigue.

Pain perception and its modulation through top-down mechanisms are also critical in effort sustainability. The lack of significant differences in pain perception across conditions suggests that the expected social modulation of pain did not occur, possibly due to insufficient activation of neuromodulatory circuits involved in social bonding. The absence of an observed benefit in pain regulation within the collective condition implies that social identification alone, without direct social engagement, is insufficient to elicit neurophysiological changes capable of altering pain experience during sustained effort.

These results underscore the necessity of distinguishing between explicit social interaction and social identification in the study of cognitive and physiological performance. This distinction aligns with research indicating that many of the neural benefits of social belonging, including pain attenuation (Roberts et al., 2015; Sharvit & Schweinhardt, 2022), time (Cravo et al., 2022) and effort perception(Davis & Cohen, 2018), are contingent on direct social presence rather than abstract identity affiliation. Thus, future research should explore how neural mechanisms of effort regulation differ between passive identification and active engagement within a group, particularly regarding their effects on cognitive control, pain processing, and endurance. Further investigations incorporating neuroimaging techniques could clarify whether the absence of direct social interaction in collective conditions modulates prefrontal and insular activity differently from conditions involving active group presence.

From a psychosocial perspective our findings reinforce the idea that social identification acts as a psychological catalyst, simultaneously amplifying motivation and shaping expectations of success. This aligns with identity-based motivation theory(Oyserman, 2009; Oyserman et al., 2017), which highlights how individuals' social identities influence their willingness to engage in and persist with goal-directed behavior (De Cuyper et al., 2016; Martin et al., 2018).

More specifically, our results indicate that athletes in the collective condition not only exhibited higher motivation than those in the individual condition but also reported greater confidence in their team's likelihood of success. This dual effect suggests that social identification regulates effort through two interrelated mechanisms: (1) by increasing an individual's initial willingness to engage in demanding tasks and (2) by fostering perseverance during task execution through an enhanced belief in the group's collective capability to achieve a successful outcome. This finding aligns with prior research showing that group-based motivation is particularly pronounced when individuals perceive their contributions as integral to the team's overall performance (Greenaway et al., 2020).

Theoretically, social identity shifts the foundation of motivation from individual self-interest to the collective pursuit of shared goals, thereby increasing the willingness to invest effort. Furthermore, the link between social identification and heightened expectations of team success resonates with research on shared cognitive representations in team dynamics. When individuals strongly identify with a group, they are more likely to adopt a collective mindset, reinforcing the belief that the team as a whole possesses the necessary abilities, strategies, and cohesion to overcome challenges (Slater et al., 2018). Such beliefs are critical, as perceived collective efficacy has been shown to enhance coordination, communication, and trust within teams, which, in turn, improves actual performance (Fransen et al., 2014).

Finally, our findings align with broader literature suggesting that team-based identification not only enhances motivation but also fosters resilience in high-pressure contexts. When athletes strongly identify with their team, they interpret setbacks as shared challenges rather than individual failures. This group-based resilience further supports sustained effort and long-term engagement, particularly in competitive environments where psychological endurance is paramount (Slater et al., 2020).

However, the stronger performance observed when athletes were less identified to their team suggests that maximizing physical effort might be more effectively achieved through individual goals rather than collective ones. Also, by isolating the effect of social identity from the immediate presence of teammates, this study advances our understanding of how social identification assessing the impact of social identification on performance, independent of direct peer influence. In that sense, we could conclude that the well-recognized positive effect of social identity may primarily depend on the physical presence of teammates; in their absence, social identification alone does not appear sufficient to enhance performance.

Conversely, participants with strong social identification held high expectations for their team's success. In the context of social identification, it is possible that athletes who strongly believe in their team's likelihood of success subconsciously adjust their exertion, relying on the collective rather than maximizing personal effort. Moreover, despite being physically alone, they may perceive their situation as part of a shared dynamic, reinforcing their expectation of collective success but potentially leading to a reduction in individual effort. This phenomenon, commonly referred to as "social loafing," occurs when individuals decrease their exertion in group settings under the assumption that their teammates will compensate for their lower engagement (Karau & Williams, 1993). Defined as "the reduction in motivation when individuals work collectively, compared with when they work individually" (Hardy & Latané, 1986), social loafing is a pervasive and robust phenomenon (Hogg & Vaughan, 2005) that causes a reduction in effort and team performance. Identifying with the group can lead players to rely on others to perform, whereas in the personal identity condition, players have no choice to rely on their own performance to succeed in the task. This dynamic provides a compelling explanation for why, despite strong team identification, individual performance did not reach its optimal level.

The current study contributes to the growing body of research on the Social Identity Approach in sport (Haslam et al., 2020), offering novel insights into the interplay between social identification and physiological performance in high-performance settings. A key contribution of this work lies in isolating the effect of social identity from the potential confounding influence of teammates' mere physical presence—a factor inherently embedded in collective training environments but absent when players have to train autonomously. By disentangling these effects, we provide a more precise understanding of the extent to which athletes commit to effortful actions for the benefit of the group, despite the individual strain experienced. This distinction is particularly relevant in elite sport, where the ability to regulate effort and tolerate physical discomfort is paramount to sustained performance. Particularly, our findings challenge the assumption that social identification inherently facilitates sustained effort. While social identity can influence motivation and resilience through shared group norms and collective goals (Haslam et al., 2020), our findings suggest its effects may be more context-dependent than previously assumed. Specifically, the lack of direct social engagement in the present study suggests that the psychological and cognitive mechanisms supporting social modulation of effort require active interpersonal interaction rather than passive identification with a collective. Future research should now explore this issue by comparing the effects of social identification on these same parameters when effort is exerted in a group setting, such as during a match. This would help determine whether the presence of teammates amplifies the benefits of social identification on effort sustainability, pain perception, and overall physical performance, or if the observed limitations persist even in direct social interaction contexts.

Limitations and Future Research

One of the main limitations of this study lies in the characteristics of the sample population. The participants were young elite athletes, whose motivational mechanisms may differ from those of professional players who are more influenced by personal incentives such as

financial rewards, media exposure, and branding opportunities. As a result, these findings cannot be directly generalized to super-elite athletes, such as Olympians, who experience a high level of individual recognition and external pressures. Future research should thus aim to replicate this study with professional athletes to determine whether the observed effects hold across different levels of competition.

Also, it worth highlighting that we didn't explore how the type of sport practiced might shape the way athletes manage their effort. Yet this could be a key factor. Each sport tends to come with its own set of values and expectations—unspoken rules about what it means to push oneself, stay engaged, or respond to fatigue. Take rugby, for instance: as a contact sport, it often fosters a culture where pushing through pain or exhaustion is seen as part of the game. In contrast, volleyball might place more emphasis on timing, coordination, and adapting to teammates, which could lead to a very different relationship with physical effort. These cultural nuances likely influence how athletes interpret their own limits and decide whether to keep going. Our relatively small sample size (54 participants) also limits our ability to detect more subtle variations between sports. Moving forward, it would be valuable for future studies to include a wider range of disciplines and participant profiles to better understand how sport-specific norms and group identities shape effort regulation (Stevens et al., 2022).

Ultimately, this study challenges conventional training approaches by demonstrating that fostering group identification alone is insufficient to optimize autonomous physical training. Accordingly, strength and conditioning trainers should prioritize individual engagement and self-regulation, ensuring that athletes remain intrinsically driven rather than overly reliant on team-oriented motivations. These findings contrast with prevailing theories and common practices in team sports, where social identity is often reinforced unconditionally.

At the same time, our results also suggest that social identity may act as a protective mechanism. While highly identified players performed worse than those with lower

identification, they paradoxically reported higher expectations of success. This indicates that coaches may instinctively strengthen team identity as a safeguard against collective collapse, even though it does not necessarily enhance individual performance. Taken together, these findings highlight the context-dependent nature of the relationship between social identity and performance, emphasizing the need for coaches to identify when prioritizing personal identity enhances personal engagement and when reinforcing social identity is more beneficial for team stability and cohesion.

Moving forward, it seems now important to explore how social identification influences perseverance in effortful tasks during real social interactions, such as competitive matches. Understanding whether the presence of teammates amplifies or mitigates these effects will be key to refining training methodologies that effectively balance individual autonomy with the benefits of team dynamics.

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Authors Contribution

Julien Pellet (1st author): Writing – original draft review and editing; **Romuald Lepers (2nd author)**: Conceptualization, Methodology, Supervision, Project administration, Writing – original draft review and editing; **Florian Vitry (3rd author)**: Methodology, Formal analysis, Investigation, Data curation, Writing – original draft review and editing; **Sofiène Harabi (4th author)**: Methodology; **Iouri Bernache-Assolant (5th author)**: Methodology; **Philippe Castel (6th author)**: Methodology; **Marie-Françoise Lacassagne (7th author)**: Methodology; **Raphaël Laurin (8th author)**: Methodology; **Alan Guyomarch (9th author)**: Writing – original draft review and editing; **Emilie Pété (10th author)**: Writing – original draft review and editing; **Mickaël Campo (11th author)**: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Writing – original draft review and editing.

Conflict of Interests

The authors report there are no competing interests to declare.

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