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Effects of achievement goals on self-regulation of eating attitudes among elite female athletes: An experimental study

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Discussion: This experimental study confirms the findings of previous correlational works and shows that achievement goals contribute to the causal processes of self-regulation of eating attitudes. These findings might help to prevent eating disorders in female athletes by providing guidance for the development of adapted motivational strategies.

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Nice, 17 April 2011

To: Dr D. ALFERMANN, Dr M. HAGGER,

Dear Dr D. ALFERMANN, Dr M. HAGGER,

Please consider the following revision of the article, " Effects of Achievement Goals on Self-Regulation of Eating Attitudes among Elite Female Athletes: An Experimental Study ", for publication in PSYCHOLOGY OF SPORT AND EXERCISE. It is 27 pages long and includes two tables.

This submitted paper is original and unpublished, and is not under consideration for publication elsewhere.

Sincerely,

Stéphanie Scoffier

Running head: ACHIEVEMENT GOALS AND SELF-REGULATION OF EATING ATTITUDES

Effects of Achievement Goals on Self-Regulation of Eating Attitudes among Elite Female

Athletes: An Experimental Study

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Abstract

Introduction: The influence of achievement goals on eating attitudes has mainly been examined through correlational studies (e.g., De Bruin et al., 2009; Duda & Kim, 1997), and none of the studies to date has focused on the self-regulation of eating attitudes in athletes. The present study experimentally tested the effects of achievement goals on both self-reported (Study 1) and behavioral indices (Study 2) of the self-regulation of eating attitudes in female figure skaters.

Method: Elite female figure skaters (Study 1: $n = 44$; Study 2: $n = 54$) were randomly assigned to one of four conditions designed to induce specific goal involvement (performance-approach, mastery-approach, performance-avoidance, and mastery-avoidance) or a control condition (no goal induction). The participants in Study 1 completed the Self-Regulation of Eating Attitudes in Sport Scale (*SREASS*, Scoffier et al., 2010c) and those in Study 2 completed a virtual behavioral measure of self-regulation of eating attitudes (*VSSR*; Scoffier, 2009).

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Keywords: achievement motivation, disordered eating attitudes, high-level sport, figure skating.

1 Effects of Achievement Goals on Self-Regulation of Eating Attitudes in Elite Female Athletes: An
2 Experimental Study

3 The term “disordered eating attitudes” describes unhealthy attitudes and behaviors that range
4 from strict dietary habits in order to lose or maintain weight to severe food restriction (Hobart &
5 Smucker, 2000). In the psychosocial literature, they are generally considered to be sub-clinical (Petrie
6 & Greenleaf, 2007), and diagnosis is based on self-reported instruments. Adolescent girls are
7 especially at risk of developing disordered eating attitudes (Jacobi, Hayward, de Zwaan, Kraemer, &
8 Agras, 2004; Polivy, Herman, Mills, & Wheeler, 2003), as are young athletes in aesthetic sports like
9 gymnastics and figure skating (Beals & Manore, 2000; Scoffier, Maïano, & Arripe-Longueville (d’),
10 2010a; Smolak, Murnen, & Ruble, 2000; Sherman & Thompson, 2009; Sundgot-Borgen & Torstveit,
11 2004). In these sports, internalization of the thin ideal and coach pressure about weight are important
12 risk factors for disturbed body image and eating pathology.

13 Sports that require the public display of physical grace and skill are typical achievement
14 contexts that favor eating disorders (Scoffier et al., 2010a), and achievement goal theories might
15 therefore provide insight into the disordered eating of female aesthetic athletes. An achievement goal
16 is a cognitive construction that reflects the aim that a person pursues in order to obtain success or
17 avoid failure (Elliot, 2005). It is a cognitive representation of a final state that gives direction to action
18 (Pintrich, 2000). Several authors have examined the relationships between both individual and
19 contextual (i.e., the motivational climate) goal orientations and eating disorders within a bidimensional
20 framework of achievement goals (De Bruin, Bakker, & Oudejans, 2009; Duda, 2001). However, this
21 research has been correlational in nature, which limits the causal interpretations about the effect of
22 achievement goals on eating attitudes. Hence, there is a need to test these potential effects through
23 experimental designs.

24 Behavioral measures of eating attitudes may raise ethical issues. As an extreme example, the
25 observation and documentation of compulsive overeating and compensatory weight control behaviors
26 outside of a treatment context would be profoundly disrespectful of the individual’s integrity. Most
27 investigators of disordered eating attitudes have thus generally relied on self-reported measures like
28 the *Eating Attitude Test* (Garner, Olmsted, Bohr, & Garfinkel 1982) or the *Dutch Questionnaire for*
29 *Eating Behaviours* (van Strien, Frijters, Bergers, & Defares, 1986). Yet, several authors have shown
30 that self-regulation and self-regulatory efficacy have an influence on eating attitudes in daily life
31 (Abusabha & Achterberg, 1997; Baranowski et al., 1997; Glynn & Ruderman, 1986; Pinto, Guarda,
32 Heinberg, & DiClemente, 2006) and, more recently, in sports contexts (Scoffier, Corrion, Paquet, &
33 Arripe-Longueville (d’), 2010c). The self-regulation of eating attitudes refers to the feeling of
34 confidence an individual has about being able to eat without engaging in disordered eating behavior or
35 experiencing undue emotional distress (Pinto, Heinberg, Coughlin, Fava, & Guarda, 2008). Self-
36 regulation mechanisms are especially crucial for athletes during competitive periods, when both social
37 comparison and social pressure to conform to an ideal body weight are high (Sherman & Thompson,

1 2009). However, the influence of achievement goals on the self-regulation of eating attitudes in
2 athletes has not been examined. The purpose of the present study was therefore to experimentally test
3 the effects of achievement goals on both self-reported and behavioral indices of self-regulation of
4 eating attitudes in female figure skaters.

5 **Self-Regulation and Eating Attitudes**

6 The concept of self-regulation has been explored in many fields of study. Self-regulation refers
7 to the capacity to control one's behavior or perform an activity, and it is a powerful predictor of
8 health-related behaviors (e.g., Rasmussen, Wrosch, Scheier, & Carver, 2006). The self-regulation of
9 eating attitudes is related to the individual's concerns about his or her body, the intensity of exercise
10 and physical activities (Desharnais, Bouillon, & Godin, 1986; McAuley, 1992; McAuley & Mihalko,
11 1998), and the degree of engagement in weight loss and nutrition programs (see Herman & Polivy,
12 2004, for a review). Altfas (2002) and Holtkamp, Konrad, and Müller (2004) showed that disordered
13 eating attitudes were more frequent in individuals with a low capacity for self-regulated eating and this
14 was corroborated by many of the studies cited in AbuSabha and Achterberg's (1997) review of the
15 literature. For example, the capacity for self-regulated eating has been found to affect students' control
16 of fruit and vegetable consumption (Baranowski, Perry, & Parcel, 1997). Recently, the self-regulation
17 of eating attitudes was found to be related to disordered eating in the sports context (Scoffier, Corrion,
18 Paquet, & Arripe-Longueville (d'), 2010c; Scoffier, Paquet, & Arripe-Longueville (d'), 2010b).

19 Self-regulation of eating attitudes is classically assessed with Glynn and Ruderman's (1986)
20 *Eating Self-Efficacy Scale* (ESES), which is composed of 25 items loaded on two factors: negative
21 affects and socially acceptable circumstances, and the *Eating Disorder Recovery Self-Efficacy*
22 *Questionnaire* (EDRSQ) of Pinto et al. (Pinto et al., 2006; Pinto et al., 2008), which is composed of 23
23 items loaded on two factors: normative self-regulation of eating attitudes and the feeling of self-
24 efficacy concerning self-image. However, as these tools are not adapted to the sports context, Scoffier
25 et al. (2010c) recently developed the *Self-Regulation of Eating Attitudes in Sport Scale* (SREASS). The
26 SREASS is composed of 16 items loaded on five factors pertaining to the self-regulation of eating
27 attitudes in the following contexts: (a) food temptation (e.g., Do you feel capable of controlling what
28 you eat when tempting food is put before you?), (b) negative affects (e.g., Do you feel capable of
29 controlling what you eat when you are anxious or worried?), (c) social interaction (e.g., Do you feel
30 capable of eating with your training partners without depriving yourself?), (d) lack of compensatory
31 strategies (e.g., Do you feel capable of making yourself vomit if you've just eaten cake at a birthday
32 celebration?), and (e) lack of anticipation of consequences on performance (e.g., Do you feel capable
33 of eating a dessert without thinking about the consequences this may have on your next competition?).
34 The questionnaire includes two inverted items.

35 In addition to the self-reported measures of self-regulation of eating attitudes, these attitudes
36 need to be assessed at the behavioral level, which directly affects personal health. However, the
37 objective measurement of disordered eating behavior is difficult to defend from an ethical standpoint.

1 For example, the daily assessment of energy intake may create social pressure on study participants
2 and cause desirability bias. Therefore, indirect measures are needed. Scoffier (2009) developed the
3 Virtual Self Service Restaurant (VSSR), an online interface that allows individuals to select foods for
4 every meal of the day and then calculates the energy intake and expenditure based on these food
5 choices.

6 **Achievement Goals and Eating Attitudes in Athletes**

7 Although several factors contributing to disordered eating attitudes have been studied in social
8 psychology (Jacobi et al., 2004) and sports psychology (Petrie & Greenleaf, 2007), the role of
9 achievement goals has not received much attention. The most recent theory of achievement goals
10 presents a four-goal framework (Elliot & McGregor, 2001), with the four types of goals lying along
11 two dimensions. The first dimension concerns the self-referenced (i.e., progressing in or mastering a
12 task) or norm-referenced (i.e., outperforming others) nature of the competence needed in pursuit of a
13 goal. Mastery and performance goals thus involve a sense of competence that is self- and norm-
14 referenced, respectively. This distinction reflects the former two-goal framework (e.g., Dweck, 1986)
15 in which mastery and performance goals were sometimes respectively called task and ego orientations
16 (Nicholls, 1989). The second dimension refers to the appetitive and aversive valences of an outcome,
17 which respectively elicit approach and avoidance goals. The four achievement goals in Elliot and
18 McGregor's framework are thus: (a) mastery-approach (MAp) goals, which combine a self-referenced
19 sense of competence and an appetitive outcome valence; (b) mastery-avoidance (MAv) goals, which
20 combine a self-referenced sense of competence and an aversive outcome valence; (c) performance-
21 approach (PAp) goals, which combine a norm-referenced sense of competence and an appetitive
22 valence of the outcome; and (d) performance-avoidance (PAv) goals, which combine a normative
23 sense of competence and an aversive valence of the outcome.

24 Duda and colleagues showed that an environment that encourages task orientation protects
25 female gymnasts from disordered eating attitudes, whereas the perception of a performance-oriented
26 climate has a negative impact on body image and weight concerns and predisposes these athletes to
27 disordered eating and low self-esteem (Duda, 2001; Duda & Bernadot, 1997; Duda & Kim, 1997).
28 Moreover, Chi (2004) showed that performance goals could lead to destructive behaviors like drug
29 abuse, alcoholism, or extreme weight control. De Bruin et al. (2009) observed that an ego orientation
30 combined with perceptions of an ego-involving training climate is positively related to dieting in
31 female gymnasts and dancers. They also found that the perception of a task-involving climate was
32 negatively related to dieting. Taken as a whole, these results confirm that achievement goal theory is a
33 heuristic framework that can account for eating disorders.

34 Scoffier, Corrion, and d'Arripe-Longueville (2009) examined eating attitudes in elite female
35 athletes using the framework of Elliot and McGregor (2001). They showed that performance approach
36 (Pap) and mastery avoidance (MAv) goals positively predicted disordered eating attitudes and could
37 thus be assumed to be risk factors. In contrast to the findings of De Bruin et al. (2009), mastery

1 approach (Map) goals did not predict disordered eating attitudes and performance avoidance (PAv)
2 goals, which are generally associated with low perceived competence (Elliot & Church, 1997),
3 appeared as protective factors. Therefore, avoidance strategies might have protected these athletes
4 from the development of disordered eating attitudes.

5 The studies that have examined the influence of achievement motivation on eating attitudes in
6 athletes have been correlational in nature and thus few conclusions could be drawn about the causal
7 role of achievement goals (De Bruin et al., 2009; Duda, 2001; Duda & Bernadot, 1997; Duda & Kim,
8 1997; Scoffier et al., 2009). Experimental investigations are needed to overcome this limitation.
9 Furthermore, no study has yet tested the impact of the activation of specific achievement goals on the
10 self-regulation of eating attitudes.

11 The aim of this study was twofold. We first experimentally tested the influence of achievement
12 goals on the self-reported measure of self-regulation of eating attitudes in elite female figure skaters,
13 using the *SREASS* (Scoffier et al., 2009). We then tested the influence of achievement goals on the
14 behavioral measure of self-regulation of eating attitudes in the same type of athlete, using Scoffier's
15 (2009) *Virtual Self-Service Restaurant (VSSR)*. This online tool permits a virtual projection of eating
16 attitudes at a specific moment in time in a particular motivational context. In both cases, we expected
17 to confirm experimentally the results of earlier correlational studies. It was assumed that capacities for
18 self-regulation of eating attitudes measured with both self-reported and behavioral instruments would
19 be higher in conditions of PAv and MAp goals than in conditions of PAp and MAv goals (De Bruin et
20 al., 2009; Duda, 2001; Scoffier et al., 2009).

21 Preliminary Study

22 A preliminary study tested whether the four states of goal involvement could be activated by
23 the experimental conditions.

24 Method

25 **Participants.** Forty-four volunteer student athletes ($M_{age} = 21$ years; $SD_{age} = .28$) were recruited
26 to test the impact of the instructions intended to induce specific achievement goals in the first
27 experimental protocol. They were randomly assigned to one of four groups and given instructions
28 designed to induce one of the four types of goals in the 2×2 model.

29 **Induction of the experimental conditions.** One of the five sets of instructions below was given
30 to the members of each group in order to induce the corresponding goal orientation: MAp ($n = 11$),
31 PAp ($n = 11$), MAv ($n = 11$), and PAv ($n = 11$).

32 Instructions for the "Mastery-Approach Goals" group: "Imagine that it's early summer. You're
33 in training and you need to make as much technical progress as possible and master as many technical
34 elements as you can."

35 Instructions for the "Performance-Approach Goals" group: "Imagine that you're in training just
36 before the French Championship selections. Your coach will be filming everyone as they do their free

1 program. Then everyone will review the best programs and the coach will select the best skaters. Your
2 performance has to be better than everyone else's if you want to be selected."

3 Instructions for the "Mastery-Avoidance Goals" group: "Imagine that it's early summer. You're
4 in training and you need to avoid making as many technical mistakes as you can and skating worse
5 than usual."

6 Instructions for the "Performance-Avoidance Goals" group: "Imagine that you're in training just
7 before the French Championship selections. Your coach will be filming everyone as they do their free
8 program. Then everyone will review the best programs and the coach will eliminate the skaters whose
9 performances were least good. You don't want to perform worse than the others so you can avoid
10 being among the skaters eliminated."

11 Instructions for the control group: "You're in training and, as you do every day, you manage to
12 balance your day between school and skating."

13 After reading the instructions, the 44 volunteer student athletes responded to the approach and
14 avoidance questionnaire for sports and physical education settings (Schiano-Lomoriello, Da Fonséca,
15 & Cury, 2005). The questionnaire had been further adapted for only a sports setting and not physical
16 education, as reflected in the following examples: "this year" was changed to "this season" and
17 "pupils" was changed to "practitioners in my sport." Three items assessed each goal (MAp: e.g., "This
18 season, I want to learn as much as possible in my sport"; PAp: e.g., "This season, it's important for me
19 to do better than other athletes"; MAV: e.g., "My goal this season is to avoid learning less than I
20 possibly could in my sport"; and PAV: e.g., "My goal this season is to avoid performing worse than
21 other athletes"). Participants responded on a Likert-type scale from 1 (*strongly disagree*) to 7 (*strongly*
22 *agree*). Each subscale exhibited satisfactory internal consistency (i.e., $\alpha > .75$).

23 Results

24 A one-way analysis of variance (Instructions \times 4) was used to test the effects of the instructions
25 on the scores for achievement goals. The instructions had significant effects on every goal: MAp, $F(3,$
26 $40) = 67.63, p < .01$, PAp, $F(3, 40) = 47.25, p < .01$, MAV, $F(3, 40) = 65.99, p < .01$, and PAV, F
27 $(3, 40) = 138.72, p < .01$. The post-hoc Student-Newman-Keuls tests then showed (a) significantly
28 higher mean scores for MAp goals ($p < .05$) when we induced MAp than in other conditions ($M_{MA} =$
29 $6.73; M_{PA} = 2.18; M_{ME} = 2.21; M_{PE} = 2.64$); (b) significantly higher mean scores for PAp goals ($p <$
30 $.05$) when we induced PAp than in other conditions ($M_{MA} = 2.03; M_{PA} = 6.55; M_{ME} = 1.94; M_{PE} =$
31 2.88); (c) significantly higher mean scores for MAV goals ($p < .05$) when we induced MAV than in
32 other conditions ($M_{MA} = 3.30; M_{PA} = 2.00; M_{ME} = 6.48; M_{PE} = 1.97$); and (d) significantly higher mean
33 scores for PAV goals ($p < .05$) when we induced PAV than in other conditions ($M_{MA} = 1.61; M_{PA} =$
34 $2.52; M_{ME} = 1.79; M_{PE} = 6.64$).

35 Discussion

1 This preliminary study confirmed that the instructions given to each group had the desired
2 impact, clearly demonstrating that each set of instructions resulted in the expression of a specific goal
3 orientation.

4 Study 1

5 Method

6 **Participants.** Forty-four nationally ranked competitive figure skaters were recruited. The
7 average age was 15.52 years ($SD_{age} = 2.43$) and all had been skating in competition for at least six
8 years. These athletes were recruited because of their particular vulnerability to the development of
9 disordered eating attitudes (Sundgot-Borgen, 1994) and their competitive experience. Their
10 vulnerability was due to the strong emphasis on physical appearance in aesthetic sports: figure skaters
11 are expected to conform to a sport-specific, ideal body shape. Judges promote an ideal of thinness and
12 many skaters believe they need to reach this ideal to be attractive and successful (Sherman &
13 Thompson, 2009). The athletes were all volunteers and the parents of minors gave their consent.

14 **Procedure.** The figure skaters were invited to complete the *SREASS* online. This gave us the
15 initial level of their self-regulation of eating attitudes in sports. They were then informed two days
16 later by instant messaging that they had to read a set of instructions. The skaters were randomly
17 assigned to one of five groups: four groups to induce the four types of goals: MAp ($n = 8$), PAp ($n =$
18 10), MAv ($n = 10$), PAv ($n = 8$), and a fifth group that served as a control group ($n = 8$). They were
19 then asked to complete a short version of the approach and avoidance questionnaire for sports and
20 physical education settings to verify that each set of instructions actually induced the desired goal
21 orientation in each group. In order to control for the first *SREASS* score, the participants completed
22 this measure twice.

23 **Measures.** The self-reported measure of self-regulation of eating attitudes in sports was
24 assessed with the *SREASS* developed and validated in French by Scoffier et al. (2010c). This tool is
25 composed of five factors pertaining to the self-regulation of eating attitudes in the following contexts:
26 (a) food temptation, (b) negative affects (c) social interaction, (d) lack of compensatory strategies, and
27 (e) lack of anticipation of consequences on performance. This scale has shown high stability over a
28 four-week period (test-retest reliability $> .70$; Scoffier et al., 2010c). The items were measured on a
29 Likert-type scale from not at all capable (1) to completely capable (6). A global index of self-
30 regulation of eating attitudes was calculated by averaging the responses to items from the five
31 subscales. This index was shown to be positively related to such widely used measures as the Eating
32 Attitudes Test (Scoffier et al., 2010c), thus confirming its external validity. In the present study, the
33 scale provided good internal consistency coefficients for each time of measure ($\alpha > .80$).

34 A short version of the approach and avoidance questionnaire for sports and physical education
35 settings (Schiano-Lomoriello et al., 2005) was administered to check that each set of instructions
36 actually induced the desired goal orientation in each group of figure skaters.

1 **Analyses.** Kruskal-Wallis analysis of variance was used to verify that each set of instructions
2 actually induced the desired goal orientation in each group. Then, after checking the assumptions
3 required for this type of analysis (e.g., especially no inter-condition differences during the first
4 measurement), one-way covariance analysis (Instructions \times 5) with the first score of self-regulation of
5 eating attitudes as the covariable was used to test the experimental condition. Finally, post-hoc
6 Bonferroni tests were performed to locate significant differences.

7 **Results**

8 **Induction of experimental conditions.** Kruskal-Wallis analysis of variance revealed a
9 significant effect of the experimental conditions ($p \leq .05$): the participants in each goal-orientation
10 group ranked this goal in first position (i.e., “the goal most important to me”), thus supporting the
11 validity of the procedure. The participants in the control group ranked MAP goals in first position.

12 **Self-regulation of eating attitudes.** Table 1 presents the descriptive statistics for each
13 experimental condition. Covariance analysis performed on the post-instruction scores of self-
14 regulation of eating attitudes highlighted a significant effect of the covariable, the level of self-
15 regulation of eating attitudes measured before the instructions [$F(5, 44) = 14.94, p < .01$], and also
16 an effect of the experimental conditions [$F(5, 44) = 184.62, p < .001$]. Subsequent post-hoc
17 Bonferroni tests indicated that the scores of self-regulation of eating attitudes in sports were
18 significantly lower for the MAV group ($p < .05$) and the PAV group ($p < .05$) compared with the
19 control group. Moreover, these scores were significantly lower for the MAV group than for the MAP
20 group ($p < .01$) and for the PAV group than for the MAP group ($p < .01$). However, the scores were
21 higher for the PAV group than for the MAV group ($p < .01$) and for the PAV group than for the PAV
22 group ($p < .05$).

23 **Discussion**

24 This study examined the influence of achievement goals on the self-reported measure of self-
25 regulation of eating attitudes. Our findings extend the correlational studies of De Bruin et al. (2009)
26 and Scoffier et al. (2009a) and confirm that MAV goals are negatively associated with the measure of
27 self-regulation of eating attitudes, leading to disordered attitudes (Scoffier et al., 2009). Analysis in
28 fact revealed that MAV goals resulted in less self-regulation of eating attitudes than PAV goals. In
29 agreement with our hypothesis based on the work of Scoffier et al. (2009), PAV goals appeared as
30 potential protective factors against disordered eating attitudes in that they were vectors for a higher
31 level of self-regulation than MAV and PAV goals.

32 MAP goals seemed to offer better protection against disordered eating attitudes than MAV
33 goals because they led to greater self-regulation of eating attitudes. Thus, as noted in the literature (De
34 Bruin et al., 2009; Duda, 2001), MAP contributed to the adoption of adaptive achievement patterns,
35 which was reflected by eating attitudes. Interestingly, the members of the control group displayed a
36 tendency to spontaneously choose MAP and their level of self-regulation was quite similar to that of
37 the MAP group. We conclude that this study demonstrated a tendency toward better self-regulation of

1 eating attitudes in PAv and MAp conditions than in MAV conditions (De Bruin et al., 2009; Duda,
2 2001; Scoffier et al., 2009). In the next study, we further explored achievement goals by examining
3 3 their impact on the behavioral measure of self-regulation of eating attitudes.

4 **Study 2**

5 **Method**

6 **Participants.** Another independent sample of 54 nationally ranked competitive figure skaters
7 7 was recruited for this study. Their characteristics and the criteria to recruit them were the same as for
8 8 Study 1. The average age was 15.71 years ($SD_{age} = 2.58$) and all participants had been figure skating in
9 9 competition for at least six years. They were volunteers and the parents of all minors gave their
10 10 consent.

11 **Procedure.** The skaters were invited to complete the *SREASS* online and two days later they
12 12 were invited into a room on their training site. As in Study 1, four groups of figure skaters were
13 13 composed based on the goals that were induced with specific instructions: MAp ($n = 10$), PAp ($n =$
14 14 12), MAV ($n = 12$), and PAV ($n = 10$). A fifth group served as a control group ($n = 10$). The short
15 15 version of the approach and avoidance questionnaire for sports and physical education settings
16 16 (Schiano-Lomoriello et al., 2005) allowed us to verify that each set of instructions actually induced the
17 17 desired goal orientation in each group, as in Study 1. Each participant was asked to complete the *VSSR*
18 18 online by choosing foods for each of five meals from among the foods offered buffet-style (i.e.,
19 19 breakfast, mid-morning snack, lunch, mid-afternoon snack, and dinner).

20 **Measures.** The self-reported measure of self-regulation of eating attitudes in sports was
21 21 assessed with the *SREASS* (Scoffier et al., 2010c), as in Study 1. The alpha coefficients were
22 22 calculated as composite reliability coefficients. Both internal consistency ($\alpha > .80$) and reliability ($\rho >$
23 23 $.80$) were satisfactory for each subscale of the *SREASS*.

24 The behavioral measure of self-regulation of eating attitudes in sports was measured with the
25 25 *VSSR* (Scoffier, 2009), a virtual interface for choosing the composition of five meals a day from a
26 26 wide range of food offerings. The perception of the quantity of each food chosen by the participants is
27 27 based on personal eating habits using measured quantities from a container. Two sports dieticians who
28 28 viewed the method as an appropriate means for assessing athletes' food habits agreed to evaluate the
29 29 interface. The participants documented the duration and intensity of their physical activity on the day
30 30 they completed the *VSSR*. The clarity of the *VSSR* interface was then tested on 15 students regularly
31 31 participating in club sports (i.e., minimum six hours per week) ($M_{age} = 21.00$; $SD_{age} = .28$). A few
32 32 adjustments in the description of quantities were made to improve the ease of use. Thus, sauces were
33 33 added to enhance the flavor of foods, and their caloric value, although masked for participants, was
34 34 calculated. The instructions designed to induce each goal orientation were given to the respective
35 35 participants before meal construction with the *VSSR* in order to ensure that food choices would reflect
36 36 the experimental condition.

1 Two sports researchers quantitatively analyzed the data concerning energy intake. The *VSSR*
2 interface assesses: (a) individual basal metabolism using the equation of Black, Coward, Cole and
3 Prentice (1996), (b) energy expenditure related to physical activity, (c) global energy expenditure, (d)
4 global energy intake, (e) the difference between energy expenditure and intake, and (f) distribution of
5 food intake over the day. Energy intake was calculated by converting the food choices over the day
6 into calories. Energy expenditure was determined by adding basal metabolism and the energy
7 expenditure related to self-reported physical activity. The difference between energy intake and energy
8 expenditure suggests the degree of self-regulation. When energy intake and expenditure are balanced,
9 good self-regulation of eating attitudes can be assumed. With increasingly greater imbalance,
10 increasingly less optimal self-regulation of eating attitudes should be suspected.

11 **Analyses.** The analyses performed in this second study were the same as those performed in the
12 first study.

13 **Results**

14 **Induction of experimental conditions.** Kruskal-Wallis analysis of variance showed a
15 significant effect of the experimental conditions ($p \leq .05$): the participants in each goal-orientation
16 group ranked this goal in first position (i.e., “the goal most important to me”), thus supporting the
17 validity of the procedure. The participants in the control group ranked MAv goals in first position.

18 Table 2 presents the descriptive statistics for each experimental condition. Covariance analysis
19 performed on the post-instruction scores of self-regulation highlighted a significant effect of the
20 covariable, the level of self-regulation of eating attitudes measured before the instructions [$F(5, 54) =$
21 $1.81, p < .05$], and also an effect of the experimental conditions [$F(5, 54) = 4.28, p < .05$].
22 Subsequent post-hoc Bonferroni tests revealed the following: scores of self-regulation of eating
23 attitudes in sports were significantly higher for the control group than for the MAv group ($p < .05$), for
24 the control group than for the PAv group ($p < .05$), for the PAv group than for the MAv group ($p <$
25 $.05$), and for the PAv group than for the PAp group ($p < .05$). Self-regulation of eating attitudes in
26 sports was significantly lower for the MAv group than for the MAv group ($p < .01$) and for the PAv
27 group than for the MAv group ($p < .01$).

28 **Discussion**

29 This study examined the influence of achievement goals on a virtual behavioral measure of the
30 self-regulation of eating attitudes in female athletes. In agreement with our hypothesis, the athletes’
31 capacity to self-regulate their eating attitudes, as assessed by the *VSSR* difference between energy
32 intake and energy expenditure, was lower in the PAv group than in the MAv group. These results are
33 consistent with the findings of previous correlational studies (De Bruin et al., 2009; Scoffier et al.,
34 2009), which showed that performance goals were associated with maladaptive achievement patterns
35 and were more likely to lead to negative eating behaviors. Furthermore, in line with the findings of
36 Scoffier et al. (2009) and our hypothesis, the capacity to self-regulate eating attitudes was lower in the
37 MAv group than in the MAv group. This result is consistent with the findings of previous studies that

1 showed that MAv goals were associated with a fear of failure (Conroy & Elliot, 2004), a lack of
2 motivation (Nien & Duda, 2008), or a decline in self-motivation (Conroy, Kaye, & Coatsworth, 2006).

3 PAv goals resulted in a higher capacity to self-regulate eating attitudes than PAp goals, as
4 suggested by Scoffier et al. (2009). As noted earlier, athletes characterized by high PAv goals might
5 have a relatively low perception of their physical abilities. From this perspective, they would be
6 unwilling to go to any lengths to achieve maximal performance and would thus avoid deviant
7 behaviors like disordered eating. However, more research is needed to support this supposition.

8 MAp goals appeared to protect against the development of disordered eating attitudes, as they
9 generated a higher capacity for self-regulation compared with MAv and PAp goals. Thus, as noted in
10 the literature (Elliot & McGregor, 2001), MAp goals were associated with adaptive achievement
11 patterns that were generalized in the present study to eating attitudes. Interestingly, the control
12 participants showed a natural tendency to pursue MAp goals. It is thus “normal” that the results
13 observed for this group were comparable to those of the MAp group.

14 **General Discussion**

15 These two studies examined the impact of achievement goals on self-reported and behavioral
16 self-regulation of eating attitudes. Differences were observed regarding the impact of each
17 achievement goal. The athletes who adopted MAv goals showed less inclination to self-regulate than
18 those who adopted MAp or PAv goals. The athletes who adopted MAp goals self-regulated more than
19 those who adopted PAp or MAv goals. In agreement with the literature, MAv goals, which are
20 generally associated with maladaptive feelings such as fear of failure (Elliot & McGregor, 2001),
21 appeared as risk factors for the development of eating disorders when compared with MAp goals,
22 because of the low associated self-regulation. The achievement goals had a similar influence on self-
23 reported and behavioral measures of self-regulation. These results within the 2×2 framework
24 complete earlier studies showing that performance goals are associated with maladaptive achievement
25 patterns with regard to eating attitudes (De Bruin et al., 2009; Scoffier et al., 2009). More generally,
26 these findings (i.e., PAp related to a low self-regulation of eating attitudes) are consistent with studies
27 indicating that transgressive behaviors are encouraged in situations in which winning is everything
28 (Corrion, d'Arripe-Longueville, Chalabaev, Schiano-Lomoriello, Roussel, & Cury, 2010). They also
29 underline the interest of taking into account both the self-reported and behavioral aspects of self-
30 regulation of eating attitudes.

31 MAp goals seemed to encourage more behavioral self-regulation than the other goal
32 orientations, which confirms that these goal orientations are adaptive with regard to eating behaviors
33 (De Bruin et al., 2009; Scoffier et al., 2009). In contrast, MAv goals were less likely to develop a
34 general tendency toward self-regulation. One explanation for this difference is that the tendency to
35 self-regulate eating behavior may be part of an ongoing obsession with food deprivation in certain
36 athletes. Adopting MAv goals and satisfying recurrent needs to deprive oneself of food may be part of
37 the same strategy for avoiding errors. This result confirms the literature that has at times presented

1 MAv goals as fostering adaptive achievement patterns. For example, these goals have been positively
2 correlated with perceived competence, effort, pleasure, and physical activity (Wang, Biddle, & Elliot,
3 2007), as well as the perception of a pleasant learning climate (Morris & Kavussanu, 2008).

4 The effects of achievement goals in general could be further assessed by taking into account
5 perceived body image, ideal body image, and undesirable body image. Woodman and Hemming
6 (2008) showed that the bigger the gap between perceived body image and undesirable body image, the
7 more individuals will seek to attain the ideal and avoid any approach toward the undesirable image.
8 Thus, an exploration of body image might provide greater insight into how athletes psychologically
9 experience their bodies and further explain the influence of achievement goals on the self-regulation
10 of eating attitudes.

11 This series of studies had limitations regarding the results. First, the data for our quite sensitive
12 variables were self-reported and may thus have been subject to social desirability bias. Second, the
13 generalizability of the results is limited because only a single and precise female population was
14 studied. Third, the participants' personal goal orientations (i.e., dispositions) were not controlled and
15 future research on eating attitudes will thus need to take into account these individual differences. In
16 addition, although we verified that the participants actually ranked the induced goal in first position,
17 other goals (PAp, PAv, MAp and MAV goals) that might have been adopted simultaneously were not
18 measured. Future studies could therefore examine the effect of an interaction of achievement goals on
19 eating attitude variables. Despite these limitations, the results of these two studies expand our
20 understanding of how achievement goals influence the self-regulation of eating attitudes in sports.
21 They can perhaps guide the motivational strategies developed by aesthetic sports coaches, and may be
22 useful for the mental preparation and health maintenance of at-risk athletes.

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Table 1

Study 1. Means (M) and Standard Deviations (SD) for Self-Regulation of Eating Attitudes in Sport Scale (SREASS) by Achievement Goal Conditions (N = 44)

Experimental conditions	M _{t1}	M _{t2}
Control (n = 8)	4.75 (.84)	4.93 (.01)
PAv (n = 8)	3.32 (.32)	4.93 (.01)
MAv (n = 10)	3.15 (.72)	4.37 (.01)
PAP (n = 10)	3.95 (.95)	4.65 (.37)
MAp (n = 8)	3.42 (.85)	4.93 (.01)

Notes. PAv: performance-avoidance, MAv: mastery-avoidance, PAP: performance-approach, MAp: mastery-approach. t1: the measure was not performed with a specific experimental condition. t2: the measure was performed after giving the instructions to induce an experimental condition. M: mean score of Self-Regulation of Eating Attitudes in Sport; standard deviation scores are presented in parentheses.

Table 2

Study 2. Means (M) and Standard Deviations (SD) of Self-Regulation of Eating Attitudes in Sport (t1: SREASS; t2: VSSR) by Achievement Goal Conditions

Experimental conditions	M _{SREASS}	M _{VSSR}
Control (n = 10)	4.38 (.96)	319.11 (434.42)
PAv (n = 10)	3.55 (.52)	590.66 (493.26)
MAv (n = 12)	3.15 (.98)	1451.72 (410.65)
PAP (n = 12)	3.42 (.62)	1481.57 (488.51)
MAp (n = 10)	3.63 (.71)	321.65 (144.96)

Notes. SREASS: Self-Regulation of Eating Attitudes in Sport Scale ; VSSR: Virtual Self Service Restaurant; PAv: performance-avoidance, MAv: mastery-avoidance, PAP: performance-approach, MAp: mastery-approach. t1: the measure was not performed with a specific experimental condition. t2: the measure was performed after giving the instructions to induce an experimental condition. M_{SREASS}: mean score of Self-Regulation of Eating Attitudes in Sport Scale. M_{VSSR}: Mean score of Self-Regulation of Eating Attitudes in Sport Scale based on the difference between the energetic expenditure and intake; standard deviation scores are presented between parentheses.

*Highlights

- ⇒ Effects of achievement goals on both self-reported and behavioral indices of self-regulation of eating attitudes in female figure skaters.
- ⇒ Induced mastery-approach goals and performance-avoidance goals resulted in higher scores for self-regulation of eating attitudes than induced performance-approach goals and mastery-avoidance goals.
- ⇒ The relationships were the same at both self-reported and behavioral levels.

Effects of Achievement Goals on Self-Regulation of Eating Attitudes in Elite Female Athletes: An Experimental Study

Point by point

Reviewers' comments:

The numbers of page are different because we refer our number to the blind manuscript.

1. page 6 (lines 19-22) the acronym of PAP, MAV, PAV and MAP goals appears for the first time. Please do the authors modify this point?
Thanks, we added it. page 4 (lines 18-22)
2. page 10 (lines 4-5) the authors indicated that "the athletes were recruited because of their particular vulnerability to the development of disordered eating attitudes". Much more detail is needed.
We added much more detail to explain this sentence page 7 (lines 9-19).
3. page 12 (lines 17-19) add goals after MAP and not only Map.
Thanks, we added it.
4. page 17 (lines 4-7)"More generally, these findings are consistent with studies indicating that transgressive behaviors are encouraged in situations in which winning is everything." Can the authors justify this sentence in relation with the results of the study?
Thanks, we added it. page 11 (lines 25-28)
5. I also noticed a number of grammatical and typographical errors. Please have a person whose first language is English proofread your article
We apologize. We corrected any grammatical errors, and the manuscript has been reading by a person whose first language is English.