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# Risk for eating disorders in "high"- and "low"-risk sports and football (soccer): A profile analysis with clustering techniques

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**Abstract**

Eating disorders (EDs) are prevalent in sports. Although a distinction has been made to date between high- and low-risk sports for EDs, recent studies have indicated that footballers and other athletes in low-risk sports are as vulnerable for EDs as athletes from sports that emphasize weight and body appearance. The aim of this study was to determine whether there are particular configurations of psychosocial risk factors for EDs among athletes from different sports (N = 357), with a special focus on football players. The Athlete's Eating Habits Questionnaire (CHAD) was used to establish intra-individual configurations through a multivariate k-means cluster analysis. We found that 10.9% of athletes and 11.4% of the footballers had scores on the CHAD ≥ 100 points, which indicates that a large number of athletes are at risk for developing or may already be suffering from an ED. Three configurations or risk profiles emerged based on the beliefs, attitudes and behaviours that reflect differential schemata for each cluster: high (8.7%), moderate (45.1%) and low (46.2%) risk. Football players had a profile that was similar to the moderate, though existent, risk cluster. Our findings also question the traditional classification of sports as high- vs. low-risk. Athletes, including footballers, may have a heightened risk for EDs when they have certain combinations of dysfunctional beliefs, attitudes and behaviours. Our findings indicate that it is important to consider relevant predisposing factors with the aims of risk detection and EDs prevention among athletes. The type of sport does not appear to be the most important risk factor.

**Keywords:** Football, Soccer, Eating Disorders, Risk, Prevention, Cluster analysis, k-means

On a continuum from *disordered* eating behaviours to eating *disorders* (EDs) (Bratland-Sanda and Sundgot-Borgen, 2013), many athletes show manifestations of an ED and many more demonstrate a combination of risk factors for developing an ED. For example, to control body weight or appearance, with both functional/athletic or aesthetic aims, they demonstrate using restrictive diets, pills, laxatives or diuretics, total or partial fasting, periods or cycles of binge eating and purging, excessive exercise and so forth, both at subclinical and clinical levels (i.e., anorexia, bulimia, binge eating and other eating disorders not otherwise specified, or EDNOS) (Bratland-Sanda and Sundgot-Borgen, 2013; Currie, 2010; Díaz and Dosil, 2012; Dosil, 2008; Glazer, 2008; Morgado de Oliveira, de Abreu & Gonçalves, 2010; Sundgot-Borgen and Garthe, 2011; Sundgot-Borgen and Torstveit, 2010; see Díaz, Godoy-Izquierdo, Navarrón, Ramírez and Dosil, 2018, for an updated review). The abovementioned literature syntheses indicate that up to 70% of athletes have clinical or subclinical manifestations of an ED, with the highest rates among high-performance and elite athletes, and prevalence may have increased in recent decades (Sundgot-Borgen and Torstveit, 2010). In Spain, recent research has shown that 11.8% of athletes and 14.2% of those in centres of High Performance and Sport Technification might be at elevated risk for an ED (Díaz and Dosil, 2012; Dosil, Díaz, Viñolas and Díaz, 2012).

Evidence has suggested that athletes from some sports are at an increased risk for an ED. Specifically, those in which a low weight or a lean body appearance is preferable for aesthetic reasons, performance advantages or weight-based classification requirements, and continuous weight monitoring and control occur; when body shape is manifest (e.g., clothes, muscularity); when aesthetic factors are valued; and when the athlete's performance is subjectively evaluated (i.e., judges vs. referees). Thus, athletes from *high-risk* sports such as aesthetics, weight-class, resistance or anti-gravitation sports are at an augmented risk for an ED compared to non-athletes and other athletes (e.g., those in *low-risk* sports such as ball sports) (Bratland-Sanda and Sundgot-Borgen, 2013; Currie, 2010; Díaz, 2014; Sundgot-Borgen and Garthe, 2011; Sundgot-Borgen and Torst-

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veit, 2010). This has also been demonstrated with Spanish athletes (e.g., Dosil et al., 2012).

However, some empirical findings challenge the existing sports classifications of high- and low-risk sports. Berry and Howe (2000) warned that *all* athletes, regardless of the sport type, may be at risk for an ED if predisposing factors are present. As such, no differences have been found in the vulnerability to and manifestations of EDs among athletes from several high- and low-risk sports (e.g., Gomes, Martins and Silva, 2011; Greenleaf, Petrie, Carter and Reel, 2009; Kirk, Singh and Getz, 2001; Sanford-Martens, Davidson, Yakushko, Martens and Hinton, 2005). Research conducted in Spain parallels this finding (e.g., Díaz and Dosil, 2012, study 2). Moreover, higher prevalence rates than those expected for a low-risk sport modality have been found in ball sports, with up to one in two athletes suffering from EDs manifestations (e.g., Díaz and Dosil, 2012; Milligan and Pritchard, 2006; Torstveit and Sundgot-Borgen, 2005; Williams, Sargent and Durstine, 2003).

For EDs in football (soccer), there is limited research (Díaz et al., 2018). Although football is not considered a high-risk sport in the "traditional classification", there is increasing evidence that altered eating behaviours and EDs manifestations at both the subclinical and clinical levels are common in this athletic modality, affecting approximately 1/4 to 2/3 of footballers (Dosil and Rodríguez, 2008, cit. Dosil, 2008; Gouttebarge, Aoki and Kerhoffs, 2015; Gouttebarge, Frings-Dresen and Sluiter, 2015). Female footballers may have an increased risk for an ED (Kirk et al., 2001; Sundgot-Borgen and Torstveit, 2007; Williams et al., 2003). Studies conducted in Spain also reveal that football players, both male and female, have risk factors for developing an ED (Díaz, 2014; Díaz and Dosil, 2012; Dosil, 2008; Gouttebarge, Backx, Aoki and Kerkhoffs, 2015). Díaz and Dosil (2012, study 2) found that footballers obtained the third highest score in a screening tool ("Cuestionario de Hábitos Alimentarios del Deportista", CHAD) among 21 sports and that female football players showed higher EDs risk compared to male footballers. With the specific aim of detecting EDs risk among football players, Díaz (2014) recently observed, in a sample of male and female football players aged 14 to 34 years old, that 15.3% of participants were at risk of developing an ED based on their scores on the CHAD (i.e., ≥ 100 points). Females had a higher global score, and 37.5% of them, compared to 32% of men, were at a high risk for an ED.

Based on the limited existing empirical evidence, this study aims to establish whether there is an increased risk among football players for having psychosocial characteristics that are related to an ED compared to other sports that are traditionally viewed as high- and low-risk modalities. Specifically, we were interested in concerns and control efforts on food and eating, weight gain concerns, body dissatisfaction and distress due to other's pressure. Athletes do not have beliefs, values, attitudes and behaviours about food, weight and body perceptions that are independent and function separately; in contrast, these psychosocial factors are interconnected and form a general schemata. Thus, to analyse their impact on the risk for an ED, it is more appropriate to examine the scheme as a whole. Moreover, if different groups of athletes share specific profiles of such schemes that reveal different levels of risk, it makes little sense to conduct nomothetic analyses using variables in isolation and descriptive data for the entire sample, which would mask the real contributions of these risk factors. These profiles, and their prevalence, may be more informative and easily interpreted than means and standard deviations for all athletes. In addition, if there are diverse configurations that are differentially associated with the risk for an ED, identifying people with these profiles and the risk factors they have, which could be the focus of tailored interventions, could help in preventing EDs in sports.

Thus, we aimed to identify groups (configurations or profiles) of athletes who share a similar pattern of beliefs, attitudes and behaviours about food, weight and the body. In the event that such configurations existed, we also wanted to investigate the characteristics of each of these profiles. Cluster analytic techniques will allow us to establish such profiles and identify their specific configuration in terms of EDs risk factors. To our knowledge, no study has examined intra-individual configurations of psychosocial risk factors for an ED at a multivariate level. Therefore, this study makes an especially interesting contribution to the field. In addition, given the lack of similar research, our hypotheses cannot be grounded on previous evidence. However, we expected to find different configurations, with at least one group with a higher risk, a group at a lower risk and an intermediate group that is differentiated from the other two profiles. We also expected to find that footballers have a profile that is similar to that of athletes with higher risk for an ED.

## Methods

### Study design

This study is a descriptive, correlational study with a cross-sectional design and it is based on self-reported data.

### Participants

A convenience sample of 528 voluntary athletes participated in the study. Of them, 171 were discarded from the analyses due to incomplete data or exclusion criteria (i.e., younger than 16 and older than 45 years old, nationality other than Spanish, non-competitive/non-federated athletic practice). Thus, a total of 357 Spanish athletes aged 16 to 45 years old (M = 21.15, SD = 6.19), 36.1% women, participated in this study. Participants practised different sports (Table 1) and belonged to several clubs and teams nationwide, competing at diverse levels (81.0% at the local, autonomic or national level; 19.0% at the international level) in different categories (47.3% cadet and juvenile categories;

52.7% senior category) with diverse levels of performance (41.2% were amateur; 43.7% were semi-professional; 14.6% were professional/elite; 0.6% unknown). They demonstrated a range from moderate to intense engagement in training and competition (M = 4.7 hours of training per week, SD = 1.33). Of them, 28.6% were integrated into a High Performance Centre (13.2% not known).

**Table 1**

*Sports included in the study*

| Sport | *High-risk* sport 45.1% | *Low-risk* sport 54.9% |
|---|---|---|
| Judo, taekwondo, wrestling | 10.3 | |
| Canoeing, rowing | 10.1 | |
| Athletics, triathlon | 7.9 | |
| Gymnastics, rhythmic gymnastics, synchronized swimming, trampoline jump | 6.5 | |
| Swimming, waterpolo | 5.9 | |
| Weightlifting, bodybuilding | 4.5 | |
| Handball, volleyball, basketball | | 22.4 |
| **Football** | | **22.1** |
| Tennis, badminton | | 3.9 |
| Golf | | 3.1 |
| Hockey | | 2.0 |
| Archery | | 1.1 |
| Fencing | | 0.3 |

*Note: Based on the classification by Torstveit and Sundgot-Borgen (2005): High-risk sports: Aesthetic, weight-class, endurance and anti-gravitation sports; low-risk sports: Power, technical and ball sports.*

Seventy-nine participants (22.1% of the sample) were football (soccer) players, whereas the remaining players were practising high-risk sports (45.1%) and low-risk sports (32.8%) considering risk for an ED based on sport type (Table 1). Table 2 shows sociodemographic and athletic data for these three subgroups.

**Table 2**

*Participants' sociodemographic and athletic data by study subgroups*

| | High-risk sports | Low-risk sports | Football | Between-group comparisons |
|---|---|---|---|---|
| Age (M ± SD) | 20.68 ± 6.54 | 20.56 ± 5.83 | 22.97 ± 5.64 | $F = 4.538$, $p = 0.011$* |
| Gender (male vs. female) (%) | 62.1 | 52.1 | 84.8 | $X^2 = 22.206$, $p = 0.000$** |
| Sport category (senior vs. junior) (%) | 46.6 | 47.0 | 73.4 | $X^2 = 17.538$, $p = 0.000$** |
| Level of performance (semiprofessional vs. amateur) (%)<br>(professional vs. amateur) (%) | 38.4<br>24.5 | 39.3<br>7.7 | 62.0<br>5.1 | $X^2 = 32.868$, $p = 0.000$** |
| Level of competition (national vs. international) (%) | 72.0 | 80.3 | 100 | $X^2 = 26.892$, $p = 0.000$** |

*** p < 0.01 * p < 0.05.*

## Measures

This study is part of a broader research that used a comprehensive assessment protocol. Given the objectives of the present study, we only used data from the "Athlete's Eating Habits Questionnaire" ("Cuestionario de Hábitos Alimentarios del Deportista", CHAD) (Díaz and Dosil, 2012), which was initially developed in the context of the Spanish athletic population. The most interesting feature of the CHAD is that it was designed to specifically assess the risk for developing an ED in sports. It consists of 30 items that are answered on a Likert-type scale from 1 = completely disagree to 6 = completely agree. Items are encompassed in four dimensions: fear of gaining weight in resting periods and use of physical activity as a method for weight loss (7 items), distress linked to weight and body appearance due to significant others' attitudes and comments (6 items), obsessive concerns regarding food, diet and weight (12 items) and body image concerns and body dissatisfaction (5 items).

The psychometric properties of the CHAD have been previously demonstrated with Spanish athletes. An Exploratory Factor Analysis (EFA) of main components and varimax rotation confirmed factorial validity with a 4-factor structure that explained 60.9% of the variance of CHAD scores. The alpha values were 0.95 for the scale and 0.92, 0.90, 0.89 and 0.71 for Factors 1 to 4, respectively, and convergent validity with the Eating Attitudes Test-40 (Garner and Garfinkel, 1979) was supported ($r = 0.62$) (Díaz and Dosil, 2012, study 1). Thus, the CHAD was considered a "reliable and valid screening tool" for the detection of EDs risk specifically in the athletic population, which possesses particular features that differentiate ED risk and manifestations in comparison to the general population (Díaz and Dosil, 2012, p. 121). A score of 100 points was considered the cutoff point for establishing the risk of developing an ED (Díaz and Dosil, 2012).

We made the following changes to the CHAD after a content analysis of the items and dimensions and an EFA with factor extraction procedure using main axes with

oblimin rotation. Items 18 and 24 (initially in Factors 4 and 1, respectively) were reallocated in Factor 3, while items 2 and 6 (initially in Factors 3 and 2, respectively) were reallocated in Factor 4. With these modifications, the internal consistency (Cronbach's alpha) was 0.93 for the full scale, and 0.90, 0.87, 0.87 and 0.65 for Factors 1 to 4 (the lower value of the last factor derives from this dimension containing the only two reverse-coded items of the CHAD; Barnette, 2000).

A percentage of participants (17.6%) also completed the Spanish version of the EAT-40 (Castro, Toro, Salamero and Guimerá, 1991). This is a validated and widely used 40-item self-report questionnaire on body-, weight- and eating-related concerns. Due to the limited number of participants who completed this instrument, data could not be included in the main analyses. For validation purposes, bivariate zero-order Pearson's correlation between the CHAD and the EAT-40 total scores was $r = 0.87$ ($p < 0.01$).

In addition, data collection included sociodemographic and athletic information, including age, sex, sport practised, sport category, level of performance and level of competition. Based on the traditional sports classifications for the risk of developing an ED (e.g., Torstveit and Sundgot-Borgen, 2005), the sports were grouped into two categories, high- and low-risk sports.

### Procedure

The athletes were invited to voluntarily participate in the study after contacting clubs and teams. Once the clubs and teams agreed to collaborate, we informed the coaching staff about the study and asked permission to conduct the assessment. Then, participants' informed consent was requested, and the surveys were completed collectively prior to a training session with the assistance of one of the researchers. The average time for completing the self-reports was 30 minutes. This study was approved by the ethics committee of the institution of one of the authors.

### Statistical analyses

After checking assumptions of normality and homoscedasticity, we conducted descriptive analyses of central tendency and dispersion of data and parametric univariate analyses of variance (ANOVA) and pairwise Student's *t* comparisons for independent samples for continuous variables (corrected when homogeneity of variances was not confirmed) and Pearson's chi square comparisons for categorical variables. In addition, to obtain different profiles based on the scores on the CHAD dimensions, a multivariate non-hierarchical k-means cluster analysis was performed, with the Euclidean distance as a measure of similarity (Jain, Murty and Flynn, 1999). We used this analysis to maximize within-group homogeneity and the separation among configurations or clusters (low between-group homogeneity). Previously, raw scores were transformed to standard scores (Z).

Given the lack of previously published empirical evidence, we tentatively explored solutions with two, three, four and five clusters. To determine the appropriate number of clusters, we calculated the pseudo-F index (PSF) (Calinski and Harabasz, 1974), which is considered the most efficient statistic for determining the goodness of fit of the cluster solution (Milligan and Cooper, 1985). The number of clusters with a greater PSF is the optimal solution. Moreover, we used the Goodman-Kruskal's λ index (the closer to 0, the better the variables are operating in configuring the clusters) and the percentage of cases correctly classified by a discriminant analysis (the higher, the better the clustering). We finally chose the 3-cluster solution because it had a higher percentage of participants that were differentially and correctly grouped in each cluster, it was the most informative with the least number of clusters (i.e., greater parsimony), it did not group a small number of atypical cases in a cluster (i.e., greater replicability) and it had an easier and more meaningful conceptual interpretation. Furthermore, this 3-cluster solution was supported by the value of PSF and λ indexes as well as the percentage of cases correctly classified (96.6%), all of which reached optimal values. An initial ANOVA revealed significant differences among the clusters for all the CHAD dimensions; consequently, all the variables were used to create the risk profiles. Once the configurations (clusters) were established, ANOVA and pairwise comparisons were conducted to explore significant differences between the profiles.

In addition, the value of ± 0.5 standard deviations of Z scores was used as criterion to set as high, moderate or low the value for each dimension; thus, scores between -0.5 and +0.5 SD around the standardized mean were considered moderate, scores higher than +0.5 SD were considered high, and scores below -0.5 SD were considered low (Nordin-Bates, Cumming, Aways and Sharp, 2011).

There were no missing or lost data for any main study variable. Cluster analytic techniques are particularly sensitive to outliers and multicollinearity. Univariate and multivariate (Mahalanobis distance test) tests confirmed the absence of outliers; thus, the cluster analysis was performed with data from all participants. No multicollinearity was detected (for all of the variables, the variance inflation factor VIF < 10, tolerance index > 0.1; the condition index, the most robust test of multicollinearity, was very low for all); thus, none of the variables was excluded from the cluster analysis.

Data analyses were performed using SPSS 19.0. The significance level was set at $p < 0.05$.

## Results

Table 3 shows the descriptive findings for the CHAD scores. The mean score obtained by athletes and footballers was moderate. Notably, 10.9% of the full sample and 11.4% of the subsample of footballers scored ≥ 100 points. Moreover, between 3.8 and 31.7% of the athletes and foot-

ballers demonstrated risky attitudes and behaviours (scores ≥ 4 points on the CHAD items), and footballers exceeded the remaining athletes in Factors 1 and 3 (data not shown, available upon request). Table 3 also shows the scores on the CHAD dimensions and comparisons between footballers and the remaining athletes. No differences were found between football players and high-risk and low-risk subgroups, except that footballers demonstrated greater fear of gaining weight in resting periods and use of physical activity as a method for weight loss compared to athletes in high-risk sports, and marginally higher obsessive concerns regarding food, diet and weight compared to athletes in low-risk sports. In addition, no differences were observed between high- and low-risk sports in the CHAD total or partial scores (data not shown, available upon request).

**Table 3**
*Participants' raw (and Z) scores on the CHAD for the full sample and study subgroups*

| Score (range of possible scores) | M ± SD full sample | M ± SD high-risk sports (Z) | M ± SD low-risk sports (Z) | M ± SD football (Z) | *F, p* high-risk vs. low-risk vs. football |
|---|---|---|---|---|---|
| CHAD global score (30-180) | 68.99 ± 26.23 | 68.32 ± 27.35 (-0.03 ± 1.04) | 67.49 ± 24.55 (-0.06 ± 0.94) | 72.59 ± 26.30 (0.14 ± 1.00) | 0.990, 0.372 |
| Factor 1: Fear of gaining weight in resting periods and use of physical activity as a method for weight loss (7-42) | 2.69 ± 1.34 | 2.47 ± 1.33 (a) (b) (-0.16 ± 0.99) | 2.77 ± 1.33 (b) (0.05 ± 0.99) | 3.03 ± 1.31 (a) (0.25 ± 0.98) | 4.983, 0.007** |
| Factor 2: Distress linked to weight and body appearance due to significant others' attitudes and comments (6-36) | 1.96 ± 1.07 | 2.04 ± 1.22 (0.08 ± 1.13) | 1.90 ± 0.95 (-0.05 ± 0.88) | 1.88 ± 0.93 (-0.07 ± 0.86) | 0.846, 0.430 |
| Factor 3: Obsessive concerns regarding food, diet and weight (12-72) | 2.10 ± 0.92 | 2.10 ± 0.92 (0.00 ± 0.99) | 1.98 ± 0.82 (c) (-0.13 ± 0.89) | 2.27 ± 1.05 (c) (0.19 ± 1.14) | 2.403, 0.092† |
| Factor 4: Body image concerns and body dissatisfaction (5-30) | 2.64 ± 0.94 | 2.71 ± 1.04 (0.08 ± 1.10) | 2.60 ± 0.87 (-0.05 ± 0.93) | 2.57 ± 0.82 (-0.08 ± 0.88) | 0.854, 0.427 |

*** p < 0.01, † p < 0.10. Similar letters indicate between-group significant differences at p < 0.01 (a) or marginally significant differences at p < 0.10 (b and c).*

To explore the existence of particular configurations of beliefs, attitudes and behaviours about food and diet, weight and body appearance, and thus the existence of possible risk profiles for EDs among the athletes, a k-means cluster analysis was conducted with the CHAD dimensions as the variables configuring the profiles. Three clusters were identified, each characterized by a different configuration of the CHAD dimensions (Figure 1). Based on these profiles, which indicated different risk configurations in relation to attitudes, beliefs and behaviours concerning food and diet, weight and body appearance, we decided to name such configurations as *high risk*, *moderate risk* and *low risk* profiles for an ED.

Cluster I (8.7% of participants) was composed of participants whose attitudes and behaviours about food and diet, weight and the body were 1.6 to 2.2 SD above the mean, standing out their excessive preoccupation with food and weight and high distress in the face of comments from significant others. Given their (standardized) dramatically raised level of concern and distress, these participants can be considered at *high risk* for an ED.

Cluster II (45.1%) was composed of participants who had attitudes and behaviours about food, weight and the body lower than 0.5 SD above the mean, although their excessive concern about gaining weight during resting periods and usage of physical activity to prevent and control weight gain was comparatively greater. Although their scores on all dimensions were close to the mean for the entire group, equivalence between them and the raw scores on the CHAD (between two and three points on a 1-6 point response scale) indicates that their levels of concern and distress are not negligible. As such, these athletes were considered at a *moderate risk* for an ED. When the profile of the football players is visually compared with the configurations of the identified clusters (Figure 1), there is a great similarity to the cluster II profile. Configurations of sports that are traditionally considered both high- and low-risk are also close to this cluster (Figure 1).

Cluster III (46.2%) included those participants who had the lowest scores on the CHAD. This subgroup showed a comparatively lower level, 0.5 to 0.8 SD below the mean for the entire group, of concern and distress about food/diet, weight and body appearance. Due to its characteristics, this configuration can be considered at *low risk* for an ED. In addition, this group showed symmetry on all of the subscales, with a slightly more pronounced trend for giving importance to the comments of coach, mates and significant others.

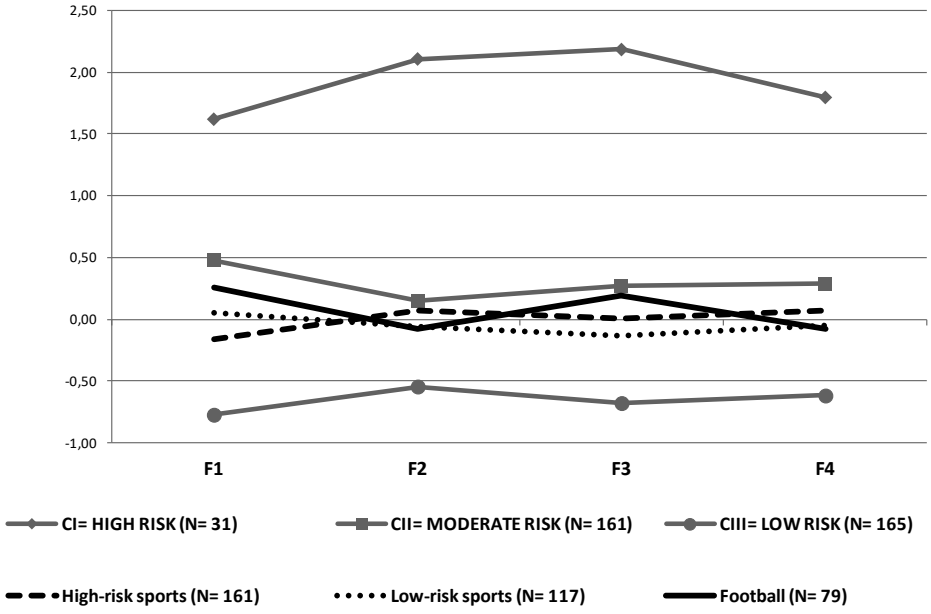


*Figure 1*: Graphical representation (centroids) of the profiles identified in the cluster analysis (data from Table 4) and Z scores of the high-risk and low-risk sports and football for comparison purposes (data from Table 3).

ANOVAs revealed significant differences among the clusters for all of the variables involved in the configuration (Table 4). *A posteriori* Bonferroni's or Games-Howell's pairwise comparisons, according to Levene's *F* value, indicated that there were significant differences among the three clusters for each CHAD dimension ($p < 0.001$).

**Table 4**
*Clusters centroids (Z scores) and comparisons for clustering variables (N= 357)*

| Variables | CI = HIGH RISK (N = 31) | CII = MODERATE RISK (N = 161) | CIII = LOW RISK (N = 165) | *F* | *p* |
|---|---|---|---|---|---|
| Factor 1 | 1.62 | 0.48 | -0.77 | 273.644 | 0.000** |
| Factor 2 | 2.11 | 0.15 | -0.54 | 202.011 | 0.000** |
| Factor 3 | 2.18 | 0.27 | -0.68 | 344.576 | 0.000** |
| Factor 4 | 1.79 | 0.29 | -0.62 | 172.139 | 0.000** |

*Note. Factor 1: Fear of gaining weight in resting periods and use of physical activity as a method for weight loss; Factor 2: Distress linked to weight and body appearance due to significant others' attitudes and comments; Factor 3: Obsessive concerns regarding food, diet and weight; Factor 4: Body image concerns and body dissatisfaction.*
*** p < 0.01, † p < 0.10.*

Given that differences were found between the sport types due to sociodemographic and athletic information (Table 2), we wished to explore possible differences by these variables in cluster configurations. Gender distribution was significantly different among the clusters ($X^2 = 6.315$, $p = 0.043$). Clusters II and III (moderate-to-low risk) encompassed 1.7 and 2.2 times more men than women, respectively (Table 5). In contrast, no differences were observed due to the participants' age ($F = 2.092$, $p = 0.125$), sports category ($X^2 = 3.978$, p = 0.409), level of performance ($X^2 = 4.109$, $p = 0.391$), level of competition ($X^2 = 5.087$, $p = 0.748$) or sport type (high- vs. low-risk sports vs. football) ($X^2 = 4.754$, $p = 0.314$). However, almost two-thirds of footballers were encompassed in clusters I and II (high-to-moderate risk), and approximately between 1/4 and 1/5 of the components in such clusters were footballers (Table 5). High- and low-risk sports for an ED were distributed among the three clusters instead of being clearly grouped in a profile that corresponded to traditional classifications (Table 5).

**Table 5**

*Composition of clusters by gender and sport type*

| | Men | Women | | Total | % Men | % Women | |
|---|---|---|---|---|---|---|---|
| CI | 14 (6.1%) | 17 (13.2%) | | 31 | 45.2 | 54.8 | |
| CII | 101 (44.3%) | 60 (46.5%) | | 161 | 62.7 | 37.3 | |
| CIII | 113 (49.6%) | 52 (40.3%) | | 165 | 68.5 | 31.5 | |
| Total | 228 (100%) | 129 (100%) | | 357 | | | |
| | **High-risk sports** | **Low-risk sports** | **Football** | **Total** | **% High-risk sports** | **% Low-risk sports** | **% Football** |
| CI | 16 (9.9%) | 8 (6.8%) | 7 (8.9%) | 31 | 51.6 | 25.8 | 22.6 |
| CII | 64 (39.8%) | 55 (47%) | 42 (53.2%) | 161 | 39.8 | 34.2 | 26.1 |
| CIII | 81 (50.3%) | 54 (46%) | 30 (38%) | 165 | 49.1 | 32.7 | 18.2 |
| Total | 161 (100%) | 117 (100%) | 79 (100%) | 357 | | | |

## Discussion

Following suggestions by Papathomas and Lavallee (2012) encouraging a broader methodological plurality in the research on EDs in sports, more use of idiographic approaches and higher attention to athletes from sports with a *low prevalence* of EDs, the present study demonstrated that football players, in contrast to traditional classifications of high- and low-risk sports based on the prevalence of EDs, constitute a group of athletes with a relevant risk for developing disordered eating behaviours or even a clinically relevant ED.

Although the mean score on the CHAD for all participants was moderate and does not appear to demonstrate noticeable risk, approximately one in ten athletes and football players could be at risk for, or suffering from, an ED. Our findings support previously published prevalence rates and parallel other findings that indicated that footballers suffer from EDs at similar rates to athletes from *high-risk* sports (e.g., Díaz, 2014; Kirk et al., 2001; Sundgot-Borgen and Torstveit, 2007; Williams et al., 2003).

However, our main goal was not to identify athletes' vulnerability for an ED based on their scores on the CHAD and its dimensions in isolation but by establishing intra-individual configurations of cognitive, attitudinal and behavioural risk factors. Cluster analytic techniques allowed us to establish such profiles and identify their specific configuration in terms of some beliefs, attitudes and behaviours related to EDs risk. We identified three clusters that were each characterized by a different configuration of CHAD dimensions (Figure 1) and indicated different risk combinations of attitudes, beliefs and behaviours about food, weight and body appearance. A small number of athletes were encompassed in a *high-risk* cluster, in which beliefs, attitudes and behaviours were very negative and dysfunctional, specifically in their excessive preoccupation with food and weight and high distress in the face of comments from significant others about their diet, weight or body appearance. The athletes in the *moderate-risk* cluster demonstrated attitudes and behaviours about food, diet, weight and the body which revealed a slight level of concern and distress. Importantly, their excessive worry about weight gain during resting periods and use of physical activity to control weight gain is of concern. Faced with the two previous clusters, which indicated that approximately 54% of the sample of athletes could have a moderate to high risk for an ED, the *low-risk* cluster showed a comparatively lower level of concern and distress in relation to food/diet, weight and body appearance. Thus, our findings, according to our analytical choice, indicated that the CHAD is a useful tool for identifying risk factors for EDs among athletes and, in particular, that the differential configurations of these risk factors as a scheme can reveal the athlete's actual vulnerability.

Another interesting contribution from the present study was that our findings revealed that the type of sport practised by the athlete is less relevant for the vulnerability for EDs compared to psychosocial risk factors. The participants who engaged in the high- and low-risk sports paradoxically shared similar configurations of the CHAD dimensions (Table 3 and Figure 1), as well as with footballers, except in one dimension in which footballers scored higher than athletes in the high-risk sports. Moreover, both profiles were similar to the moderate-risk cluster based on the CHAD dimensions. Furthermore, the composition of clusters based on the classification of sports as high- and low-risk is striking (Table 5). This is consistent with other research (e.g., Díaz and Dosil, 2012, study 2; Gomes et al., 2011; Greenleaf et al., 2009; Kirk et al., 2001; Milligan and Pritchard, 2006; Sanford-Martens et al., 2005; Torstveit and Sundgot-Borgen, 2005; Williams et al., 2003) and questions the usefulness of establishing the risk for an ED based on the sport type, at least exclusively.

However, the main contribution of this study was the specific identification of the risk of an ED among football players. When the football players' profile is visually compared to the configurations of the identified clusters (Figure 1), there seems to be a great similarity with the moderate-risk profile, instead of the low-risk profile, which was expected given the traditional classification of sports. Most of the football players (62%) were encompassed in the risk clusters, namely, clusters I and II, and approximately

one-fifth to one-quarter of the components of these clusters were football players. Findings also revealed that these athletes shared many risk factors with athletes from both high- and low-risk sports (Table 3). This confirmed that classifying sports as high vs. low risk is not useful for identifying an athlete's actual risk and indicated that it is important to view footballers as a group that has a significant risk for an ED based on their particular beliefs, attitudes and behaviours related to food, weight and body appearance (Díaz, 2014; Sundgot-Borgen and Torstveit, 2007).

Despite the contributions of this study, there are several limitations. Future research should increase the number and heterogeneity of participants and sport modalities to enhance the generalizability of the results. Given the small number of female participants (particularly in the subgroup of football players), we limited our analyses on gender differences. Paralleling other findings (Bratland-Sanda and Sundgot-Borgen, 2013; Díaz and Dosil, 2012; Morgado de Oliveira et al., 2010; Sundgot-Borgen and Torstveit, 2007, 2010), women demonstrated higher risk for an ED. However, consistent with previous findings that were obtained with Spanish football players (Díaz, 2014) and increased EDs prevalence rates observed among men (Bratland-Sanda and Sundgot-Borgen, 2013; Glazer, 2008), our findings do not support gender differences when the highest risk for ED is observed (i.e., the gender configuration of cluster I). Gender effects merit future research efforts. More research is also needed on the role of athletic factors (e.g., age/category, level of performance and competition, player's position), for which contradictory evidence has been found (Bratland-Sanda and Sundgot-Borgen, 2013; Díaz and Dosil, 2012; Díaz, 2014; Kirk et al., 2001; Sundgot-Borgen and Torstveit, 2007, 2010; Williams et al., 2003). Self-reported data based on a questionnaire were used. Even when it has been recommended that the diagnosis of an ED is to be made with a clinical interview (Bratland-Sanda & Sundgot-Borgen, 2013), many experts opt to use validated questionnaires. However, most questionnaires for the screening of EDs in sports, such as the EAT-40, were designed to assess features of one ED (i.e., anorexia nervosa) in the general population, and thus the actual prevalence of disordered eating among athletes is probably underestimated (Morgado de Oliveira et al., 2010). Thus, we decided to use a tool specifically designed to assess the most important manifestations of disordered eating, body image concerns and EDs symptoms in athletes. However, because EDs are a multifactorial problem, more risk factors for establishing multidimensional psychosocial profiles should be included for risk identification (see Díaz et al., 2018, for a review). Finally, this was a descriptive, cross-sectional study that was limited to finding clusters of individuals based on communalities. Thus, our findings should be replicated and expanded using other research designs and analytical techniques.

In conclusion, our findings suggest that football players are not *per se* at a low risk for EDs, as was traditionally thought, and they share characteristics with other groups of athletes who are at an increased risk for developing an ED. Therefore, in establishing vulnerability for EDs, it is not so useful to simply rely on the classification of sports into high- and low-risk modalities based only on the prevalence of EDs. In contrast, examining particular configurations of risk factors at the individual level is more interesting and productive. In this study, we detected three intra-individual profiles that were clearly differentiated from each other and revealed that the beliefs, attitudes and behaviours that are related to food and diet, weight and body appearance form a specific schemata that, in turn, informs of the risk for an ED among athletes. In addition, we have confirmed, based on these general patterns, that football players are similar to a moderate-risk profile. All this should alert specialists to identify athletes who are at an increased risk for EDs and to develop appropriate preventive actions.

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**Riesgo de trastornos de la alimentación en deportes de "alto" y "bajo" riesgo y fútbol: Un análisis de perfiles con técnicas de clusterización**

**Resumen**

Los trastornos de la alimentación (TAs) son prevalentes en el ámbito deportivo. Aunque tradicionalmente se ha distinguido entre deportes de alto y bajo riesgo de TAs, trabajos recientes indican que los futbolistas y otros deportistas de "bajo" riesgo son tan vulnerables como otros atletas en cuya práctica deportiva se enfatiza el peso y la apariencia corporal. El objetivo de este estudio fue conocer si existen configuraciones particulares de características psicosociales de riesgo de TAs entre deportistas de diferentes modalidades deportivas (N = 357), con un interés especial en futbolistas. Se utilizó el Cuestionario de Hábitos Alimentarios del Deportista (CHAD) para establecer dichas configuraciones intraindividuales a través de un análisis multivariado de cluster de k-medias. Un 10.9% de los deportistas y un 11.4% de los futbolistas obtuvieron puntuaciones en el CHAD ≥ 100 puntos, lo que señala que un elevado número de deportistas puede desarrollar un TA a lo largo de su carrera deportiva, o lo puede estar padeciendo ya. Aparecieron tres configuraciones o perfiles de riesgo de TAs en virtud de las creencias, actitudes y comportamientos particulares que conforman un esquema diferencial en

cada clúster: Alto (8.7%), moderado (45.1%) y bajo riesgo (46.2%). Los futbolistas muestran un perfil muy parecido al del clúster de riesgo moderado, aunque existente. Los hallazgos obtenidos también cuestionan las clasificaciones tradicionales de los deportes como de alto y bajo riesgo. Los deportistas, incluyendo los futbolistas, pueden tener un riesgo acentuado de padecer TAs si se dan ciertas combinaciones de creencias, actitudes y conductas disfuncionales. Nuestros resultados señalan la importancia, de cara al establecimiento del riesgo y la prevención de TAs en deportistas, de considerar factores predisponentes relevantes, entre los que el tipo de deporte parece no ser el más importante.

**Palabras clave:** Fútbol, Trastornos de Alimentación, Riesgo, Prevención, Análisis de Conglomerados, k-medias

**Risco de transtornos alimentares em esportes de "alto" e "baixo" risco e futebol: uma análise de perfil com técnicas de clusterização**

**Resumo**

Os transtornos alimentares (TAs) são prevalentes em esporte. Embora tradicionalmente uma distinção tem-se realizado entre esportes de alto e baixo risco de TAs, estudos recentes indicam que os futebolistas e outros atletas de risco "baixo" são tão vulneráveis como outros atletas em esportes onde o peso e aparência física são enfatizados. O objectivo deste estudo foi determinar se existem configurações particulares de fatores psicossociais de risco de TA em atletas de esportes diferentes (N = 357), com um interesse especial em jogadores de futebol. O Questionário de Hábitos Alimentares do Atleta (CHAD) foi utilizado para estabelecer configurações intra-individuais do risco através de uma análise multivariada de clusterização de K-médias. Encontramos que o 10.9% dos atletas e 11.4% dos jogadores de futebol tiveram pontuações no CHAD ≥ 100 pontos, o que indica que um grande número de atletas pode desenvolver um TA ao longo de sua carreira, ou ele já pode estar sofrendo un TA. Três configurações ou perfis de risco de TAs emergiram com base nas crenças, atitudes e comportamentos que reflectem um esquema diferencial determinado em cada grupo: alto (8.7%), moderado (45.1%) e baixo risco (46.2%). Os futebolitas mostraram um perfil semelhante ao cluster de risco moderado, embora existente. Nossos resultados questionam as classificações tradicionais de esportes como alto e baixo risco. Os atletas, incluindo os jogadores de futebol, podem ter um risco elevado de TAs se ocorrem determinadas combinações de crenças, atitudes e comportamentos disfuncionais. Nossos resultados indicam a importância para o estabelecimento do risco e prevenção de TAs em atletas do considerar fatores predisponentes relevantes. O tipo de esporte não parece ser o fator de risco mais importante.

**Palavras-chave:** Futebol, Transtornos Alimentares, Risco, Prevenção, Análise de Cluster, k-médias

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