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Mental health, eating behaviour and injuries in professional dance students

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ABSTRACT

A high frequency of mental health challenges and injuries in professional dancers necessitate a better understanding of the complexity of such symptoms, and to explore differences according to sex, academic year and performance levels. Professional dance students were recruited to evaluate symptoms of depression and anxiety (SCL-10), resilience (RSA), self-esteem (RSS), perfectionism (CAPS), body appreciation (BAS-2), and symptoms of low energy availability (LEA, LEAF-q) and eating disorders (ED) (EDE-q). Totally 20–54% of the dancers had symptoms of anxiety or depression, LEA (in females), ED and/or injuries, and 12% had a self-reported history with ED. In females, 44% of the variability in SCL-10 was explained by CAPS and RSS; 15% of variability in LEA was explained by EDE-q and training volume; while BMI, academic year and LEA increased the odds ratio of an injury. In all, BAS-2 reduced the odds ratio of EDE-q by -3.33. Totally 50% reported that they could identify personal mental health problems, still <45% would consult a health professional. Enhanced body acceptance may reduce the frequency of mental health challenges in dancers, and improved knowledge of nutrition and body weight regulation may reduce the high frequency of LEA, disordered eating behaviour, and injuries.

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Perfectionism; self-esteem; body appreciation; depression; energy availability; eating disorders; dance; ballet; contemporary; jazzdance

Introduction

Professional dancers in contemporary dance and ballet have long training sessions, in which they practice repetitive movements towards perfection and according to specific choreography, and this is both physically stressful and cognitively exhausting (Ekegren, Quested, and Brodrick 2014; Grove, Main, and Sharp 2013; Kenny, Whittaker, and Emery 2016). Additionally, the training routines often require mental tolerance for pain when exceeding anatomical limitations, and an ability to withstand the natural reaction of wanting to stop the movement (Lampe et al. 2019; Diogo, Ribas, and Skare 2016). As such, the dancers are vulnerable for physical fatigue, psychological distress, and injuries (Grove, Main, and Sharp 2013; van Winden et al. 2019, 2020b). Furthermore, the

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culture in performing arts such as dance idealises lean and light weight bodies: having strong bodies, but without the typical bulk found in other lean and toned athletes (Thomas, Keel, and Heatherton 2005; Dantas et al. 2018; Liu et al. 2016). Such appearance focus has been identified as a risk factor for body image issues, mental health problems, symptoms of low energy availability (LEA), injuries, and eating disorders among athletes representing different sports (Bratland-Sanda and Sundgot-Borgen 2013; Mountjoy et al. 2018) and specifically also in dancers (Civil et al. 2018; van Winden et al. 2020a; Mainwaring and Finney 2017; Dantas et al. 2018; Liu et al. 2016; Ribeiro and Da Veiga 2010; Arcelus, Witcomb, and Mitchell 2014). The documented prevalence of eating disorders in female dancers representing different dance genres is 12–26.5%, (Arcelus, Witcomb, and Mitchell 2014; Liu et al. 2016), and LEA and its related conditions have been reported at frequency corresponding to 24% (Robbeson, Kruger, and Wright 2015). The high level of perfectionism (i.e. a pursuit of high standards and overly self-criticism over not meeting standards) found in dancers (Eusanio, Thomson, and Jaque 2014; Goodwin et al. 2014; Nordin-Bates, Walker, and Redding 2011) underlines the concern for their mental health, as this associates to psychopathology (Limburg et al. 2017) and specifically to eating psychopathology in dancers (Goodwin et al. 2014).

Summarizing previous findings, there seems to be a high frequency of mental health challenges in dancers in different genres and of different sex; including low self-esteem (Kosmidou, Giannitsopoulou, and Moysidou 2017; Bettle et al. 2001; Eusanio, Thomson, and Jaque 2014), low resilience (Arbinaga 2018), and anxiety and depression (Nascimento, Luna, and Fontenelle 2012; Liu et al. 2016). Still, despite high prevalence of mental health issues; utilization of health service seems to be low (Alimena et al. 2016), and mental health literacy in professional dancers is poorly explored (Kozai and Ambegaonkar 2020). Furthermore, few studies have explored the differences in such mental health challenges according to academic year, at different performance levels, and few have included male dancers, or compared the severity in male dancers towards female dancers.

To better grasp the complexity of mental health challenges in a mixed group of male and female dancers, and to understand how such symptoms co-occur with or exaggerate each other, there is a need for a wider perspective of mental health symptoms. Such increased understanding may aid in finding ways to better help the dance students; improving their wellbeing and extending their career. Also, an important aspect of mental health challenges, is the mental health literacy. Hence, it is interesting to know whether dancers identify mental health problems, and if they consult professional help.

Therefore, the four aims of the current study were to investigate;

(1) Prevalence of mental health challenges, LEA, and injuries in professional male and female dance students representing different dance genres.
(2) Any differences between two schools with different performance level, between academic year, or between sexes, in such symptoms.
(3) Explanatory variables for symptoms of eating disorders, symptoms of LEA, symptoms of anxiety and depression, and for likelihood of having an injury.
(4) Awareness of personal mental health symptoms and willingness to consult with a mental health professional.

Methods

Study design and recruitment procedure

The current study is a national cross-sectional study of professional dance students from Norway. Participants represent the responding students (84% and 86%) from the total student samples at two schools recruited for an intervention study aiming at increasing awareness of mental health symptoms and knowledge on optimal physical exercise recovery strategies (Figure 1).

Ethics

This study has been approved by the Norwegian Regional Committee for Medical and Health Research Ethics (ID 11472), registered in the Norwegian Centre for Research Data (ID 194211), and in clinical trial (ID: NCT04085861). After consent from the academic deans at the two national schools offering professional dance education; students were informed about the study through a meeting, followed by a personal e-mail with an individual request for participation, followed by a letter of consent.

They accepted by pressing 'yes' to the question of consent and were redirected to the online questionnaire developed through the web-based system SurveyXact 8.2 offered by Rambøll, Aarhus, Denmark

Participants

A total of 76 dance students at school-1 and 48 dance students at school-2 were included in this study. The dancers were 20.7 (20.4, 20.9 95% CI) years of age, and studied to become professional dancers. They represented the two dance genres jazz dance and contemporary dance within the 1st, 2nd, and 3rd year of a bachelor study. Whereas students from school-1 receives a bachelor in dance with pedagogy, the students from school-2 receive a bachelor in jazz dance or in contemporary dance. Hence, it's reasonable to suggest the physical level of dance performance is higher at school-2.

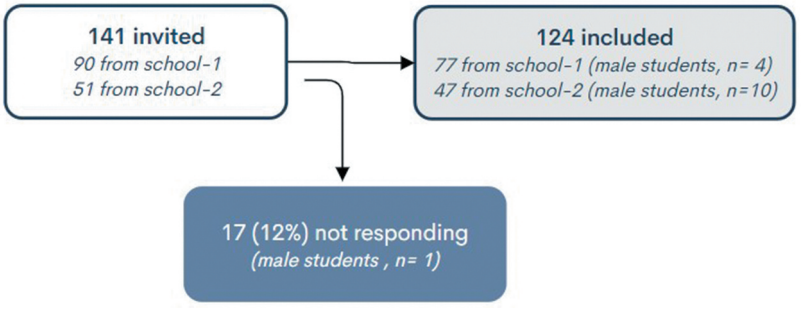

Figure 1. An overview of invited participants, the numbers not responding to recruitment, and the total number included; also separated by schools.

Questionnaires

All participants responded to a questionnaire relating to demographic information, training volume, and frequency and type of injuries depriving them from dance routines. Included in the questionnaire was also a question on whether they ever had been told by a health professional that they had an eating disorder, and questions on their general awareness of personal mental health; scored by a 5-point Likert-response rate ranging from 1 (strongly disagree) to 5 (strongly agree). Additionally, questions on meal frequency, with 6-point Likert-response scale from 0 (never) to 5 (always) and standardized instruments were included.

Hopkins symptom check list (SCL-10)

The SCL-10 (Cronbach's $\alpha = 0.88$) is a short version of the SCL-25 (originally short form of SCL-90), which validly and reliably measures symptoms of depression (six items) and anxiety (four items) (Strand et al. 2003). It consists of 10 questions scored from 0 to 4, and all are averaged into a global score, in which higher scores present higher severity of symptoms. A cut-off score of 1.85 indicates symptoms of mental health issues (Strand et al. 2003).

The resilience scale for adults (RSA-12)

The RSA-12 (Cronbach's $\alpha = 0.88$) is a short version of the original 33-items RSA, created by selecting four of the highest loading's items from each of the three questionnaire factors (Friborg, Sørlie, and Hansen 2017). RSA measures the resilience to overcome difficulties in life measured by three domains; personal competence (psychological attributes) (5 questions), familial coherence (4 questions), and social competence (3 questions). All questions are scored on a 5-point Likert scale, and results in an averaged mean value, of which higher score indicates higher resilience.

Rosenberg self-esteem scale (RSS)

The RSS (Cronbach's $\alpha = 0.88$) measures global self-worth by 10 items answered on a 4-point Likert-scale ranging from strongly agree (1) to strongly disagree (4) (Rosenberg 1965). Five of the items are positively worded, with the rest negatively worded. Scores are achieved by reversing the scores of the negatively worded items, and then summing the total scores of the 10 items. Total score ranges from 10 to 40, with higher total score indicating higher level of self-esteem. In the current paper mean scores are presented (i.e. 1–4).

Children and adolescent perfectionism scale (CAPS)

CAPS (Cronbach's $\alpha = 0.91$) is an adapted version of the full-scale questionnaire on perfectionism for adults (Multidimensional Perfectionism Scale) (Flett et al. 2016; Frost et al. 1990). It consists of 22 items measuring the intensity perfectionism reported by children and adolescents, but has also been used for age groups up to at least 25 years of age (Frost et al. 1990; Vicent et al. 2019). It is scored by a Likert-scale of 1 (false, not true at all) to 5 (very true for me) and may be divided into two subscales; self-oriented

perfectionism (SOP, 12 items) and socially-prescribed perfectionism (SPP, 10 items). The scores of three items (SOP10, SPP20 and SOP22) are reversed before a mean score is calculated for each subscale.

Body appreciation scale (BAS-2)

The BAS (Cronbach's α = 0.94) was used to measure body appreciation, specifically measuring how participants are valuing their body and their level of orienting cognitive processing to protect and promote a positive view of the body (Tylka and Wood-Barcalow 2015). Participants respond to 10-items on a Likert scale ranging from 1 (Never) to 5 (Always), with a higher average score indicating a higher level of body appreciation. The BAS-2 has been found with optimal validity and reliability (Lemoine et al. 2018).

Low energy availability in female questionnaire (LEAF-q)

The LEAF-q screens for LEA in female athletes, and identifies the occurrence of injuries, gastrointestinal dysfunction and menstrual irregularities (Melin et al. 2014). It has optimal sensitivity and specificity to identify LEA, reproductive function and bone health in female endurance athletes and dancers (Melin et al. 2014). Suggested cut-off's for GD, MI, and for the total LEAF-Q scores are ≥2, ≥4, and ≥8, respectively, with higher scoring indicating more severe clinical condition. We defined symptoms of amenorrhea if menstrual bleedings had been absent for 3 months or more, evaluated among those not reporting to use any hormonal contraceptives.

Eating disorder examination questionnaire (EDE-q)

The EDE-q (Cronbach's α = 0.95) is a self-report questionnaire measuring the symptoms of eating disorders (Fairburn and Beglin 2008). It consists of 28 questions, of which 22 questions are scored on a Likert-scale of 0–6 and divided into four subscales (shape-, body weight-, and eating concern, and eating restriction) and averaged into a global score, and six questions measure frequency of binge-eating and purging behaviour. A frequency of any uncontrolled overeating (binge eating, EDE-q-14) or purging behaviour (EDE-q-16-18) ≥ 4 times per month corresponds to the clinical cut-off for a diagnosis of eating disorder (i.e. disordered eating behaviour) (American Psychiatric Association 2013). A EDE-q global cut-off score of 2.5 has previously been found to identify the probability of having an eating disorder (Rø, Reas, and Stedal 2015).

Statistics

All data were analysed with SPSS version 26 (IBM, Armonk, NY). Data were visually inspected for normality, and presented as mean (99% confidence interval, CI) if normal distributed or as median (range) if being non-parametric. Categorical data were compared by Pearson's chi-squared test, while continuous data were compared by independent samples *t*-test and one-way ANOVA, or by Mann-Whitney U and Kruskal Wallis-H for non-parametric variables. Demographic data were presented as mean (95% CI), and a significance level of 0.05 was set as adequate to detect any differences in demographics.

Considering the explorative approach of this study, a Bonferroni correction (p = .05/98 tests) was considered too conservative, hence p values ≤0.01 were evaluated as statistically significant for all main analyses.

We also performed bivariate correlations, followed by multiple linear regressions, to explore variability in symptoms of eating disorders (EDE-q global score), in symptoms of LEA (LEAF-total score) in females, and in symptoms of anxiety and depression (SCL-10 total score), respectively. Additionally, we explored explanatory variables for the occurrence of injuries the current year by binominal logistic regression.

Results

In total 124 (88%) dance students responded to the baseline questionnaire, of which 14 (12%) were males (see Table 1). There were significantly more males in S-2 (n = 10) compared to S-1 (n = 4) (p = 0.006). BMI (p = 0.001) and total number of hours in training (p = 0.001) differed between schools. There was a difference in age of dance-career initiation between 1st and 2nd year students (p = 0.02), and 1st year students were significantly less physically active than 2nd (p = 0.005) and 3rd year students (p < 0.001).

Symptoms of depression or anxiety (SCL), perfectionism (CAPS), self-esteem (RSS), body appreciation (BAS), and resilience (RSA)

Mean scores in SCL, CAPS, RSS, BAS, and RSA are presented in Table 2. The mean scores in SCL were above suggested threshold for high risk of anxiety and/or depression (i.e. 1.85). There were no significant differences between sexes, other than a marginal difference in self-esteem and a significant difference in resilience (see Table 2). Numbers from the total sample with total score of SCL above cut-off was 67 (54%), corresponding to 63 (57%) females and 4 (29%) males (p = 0.04).

Meal frequency

In the total sample, 82% reported to eat breakfast at least 5–6 days a week. The corresponding finding for intake of lunch, dinner, evening meal and snack/recovery meals was 95%, 90%, 40%, and 55%, respectively. There were no differences between sexes, schools or academic year in meal frequencies.

Symptoms of low energy availability (LEAF-q)

In the total sample of female dancers (n = 110), the mean (Sd) LEAF-q score was 8.5 (4.1), the mean (Sd) subscale score of 'menstrual irregularities' (MI) was 3.4 (2.4), and the mean (Sd) subscale score of 'gastrointestinal dysfunction' (GD) was 3.4 (2.5). The mean score in LEAF-GD and LEAF-total were both above suggested cut-offs, and the total numbers of participants above the three respective cut-offs are illustrated in Figure 2.

Table 1. Demographic information on participants. Presentation is according to the total sample, and sorted by schools, and academic year. Results are mean (95% CI), and effect size is by Hedges *g*.

						Dance genres		
Participant	Sex	Age	BMI	Age of dance career initiation	Age of dance-profess.	Jazz	Cont.	PA[#], h/wk
Total, *n* = 124	F = 110 (89%) M = 14 (11%)	20.7 (20.4, 20.9)	21.4 (21.0, 21,8)	8.2 (7.4, 9.0)	16.2 (15.7, 16.4)	72 (58%)	52 (42%)	21.0 (58)
Females *n* = 110		20.6 (20.2, 20.8)	21.5 (21.1, 21.9)	7.6 (6.8, 8.4)	16.1 (15.6, 16.7)	65 (59%)	45 (41%)	21.9 (19.7, 24.2)
Males *n* = 14		21.5 (20.3, 22.7)	20.9 (20.0, 21.9)	12.6 (10.5, 14.6)	16.6 (14.8, 18.5)	7 (50%)	7 (50%)	26.1 (20.4, 31.9)
Diff. between sexes		-0.9 (-1.9; -0.0)	0.6 (-0.7; 1.7)	-4.9 (-7.2; -2.6)	-0.5 (-2.1; 1.2)	F = 65 M = 7	F = 45 M = 7	-4.3 (-10.7; 2.2)
		p = 0.04 *g* = *0.54*	*p* = 0.36 *g* = *0.26*	*p* < 0.001 *g* = *-1.21*	*p* = 0.57 *g* = *-0.15*	*p* = *0.20*		*p* = 0.19 *g* = *-0.36*
Schools								
S1, *n* = 77 (*62%*)	F = 73 M = 4	20.6 (20.2, 21.0)	21.9 (21.4, 22.4)	8.1 (7.1, 9.1)	16.3 (15.6, 17.0)	45 (58%)	32 (42%)	16.0 (56)
S2, *n* = 47 (*38%*)	F = 37 M = 10	20.8 (20.3, 21.3)	20.7 (20.2, 21.2)	8.3 (7.0, 9.7)	16.1 (15.3, 16.8)	27 (57%)	20 (43%)	26.0 (46)
Diff between schools		-0,2 (-0.8; 0.4)	1.2 (0.5; 2.0)	-0.2 (-1.8; 1.4)	0.26 (-0.8; 1.3)			-7.0 (-11.1; -2.9)
		p = 0.59 *g* = *-0.12*	*p* = 0.002 *g* = *0.58*	*p* = 0.79 *g* = *-0.05*	*p* = 0.64 *g* = *0.08*	*p* = *0.19*		*p* < 0.001 *g* = *-0.38*
Academic year								
1st year, *n* = 46 (*37%*)	F = 43 M = 3	19.5 (19.1, 19.8)	21.6 (20.9, 22.3)	7.0 (5.9, 8.2)	16.2 (15.4, 17.0)	26 (57%)	20 (43%)	14.0 (42)
2nd year, *n* = 38 (*31%*)	F = 28 M = 10	21.0 (20.5, 21.5)	21.4 (20.7, 22.1)	9.7 (8.2, 11.2)	16.7 (15.8, 17.6)	20 (53%)	18 (47%)	20.5 (53)
3rd year, *n* = 40 (*32%*)	F = 39 M = 1	21.7 (21.3, 22.2)	21.3 (20.6, 21.9)	8.0 (6.7, 9.6)	15.8 (14.7, 16.9)	26 (65%)	14 (35%)	24.0 (58)
Diff. between. acad.years		*p* < 0.001*	*p* = *0.75*	*p* < 0.001**	*p* = *0.38*	*p* = 0.32		*p* < 0.005***

S-1, school-1; S-2, school-2; F, female; M, male; CI, confidence interval; Profess., professionalisation; jazz, jazzdance; cont, contemporary dance; PA, physical activity; h, hours; [#] median (range); * significant different to 2nd and 3rd year students ($p < 0.001$); **significant different to 2nd year students ($p = 0.02$); *** 1st year significantly different to 2nd year ($p = 0.005$) and to 3rd year ($p < 0.001$).

Table 2. Symptoms of depression or anxiety, perfectionism, self-esteem, body appreciation, and resilience. Presentation is according to the total sample,and sorted by schools, and by academic year. Results are mean (99% CI) if not otherwise stated.

Participant	SCL	CAPS SOP	CAPS SPP	RSS	BAS	RSA
Total, *n* = 124	2.0 (1.9, 2.2)	3.3 (3.1, 3.5)	2.7 (2.5, 2.9)	2.3 (2.2, 2.5)	3.5 (3.3, 3.7)	3.7 (3.5, 3.8)
Females *n* = 110	2.1 (1.9, 2.3)	3.3 (3.2, 3.5)	2.7 (2.5, 2.9)	2.3 (2.2, 2.5)	3.4 (3.3, 3.7)	3.6 (3.5, 3.8)
Males *n* = 14	1.7 (1.3, 2.1)	3.1 (2.6, 3.7)	2.4 (1.9, 3.0)	2.0 (1.5, 2.4)	3.9 (3.1, 4.6)	4.1 (3.8, 4.3)
Diff between sexes	0,4 (-0.1, 0.9)	0,19 (-0.3, 0.7)	0.26 (-0.3, 0.9)	-0.38 (-0.0, 0.8)	-0.38 (-0.98, 0.20)	-0.45 (-0.7, -0.2)
	$p = 0.03$	$p = 0.33$	$p = 0.24$	$p = 0.014$	$p = 0.09$	$p < 0.001$
	$g = 0.67$	$g = 0.28$	$g = 0.38$	$g = 0.76$	$g = -0.50$	$g = -0.78$
Schools						
S-1, *n* = 77 (*62%*)	2.1 (1.9, 2.4)	3.4 (3.2, 3.6)	2.8 (2.5, 3.0)	2.4 (2.2, 2.6)	3.4 (3.1, 3.6)	3.6 (3.4, 3.8)
S-2, *n* = 47 (*38%*)	1.9 (1.6, 2.1)	3.2 (2.9, 3.4)	2.5 (2.2, 2.8)	2.2 (1.9, 2.4)	3.7 (3.4, 4.0)	3.9 (3.6, 4.1)
Diff. between schools	0.27 (0.0, 0.5)	0.23 (-0.0, 0.5)	0.24 (-0.0, 0.5)	0.23 (-0.0, 0.5)	-0.33 (-0.6, -0.0)	-0.30 (-0.5, -0.1)
	p = 0.03	*p = 0.08*	*p = 0.11*	*p = 0.03*	$p = 0.03$	*p = 0.013*
	g = 0.45	g = 0.29	g = 0.39	g = 0.35	*g = –0.42*	g = -0.47
Academic year						
1st year, *n* = 46 (*37%*)	2.0 (1.7, 2.3)	3.3 (3.0, 3.5)	2.6 (2.3, 2.9)	2.4 (2.2, 2.6)	3.4 (3.1, 3.7)	3.7 (3.4, 3.9)
2nd year, *n* = 38 (*31%*)	2.0 (1.8, 2.3)	3.3 (3.0, 3.6)	2.7 (2.3, 3.0)	2.3 (2.0, 2.5)	3.4 (3.0, 3.8)	3.6 (3.3, 3.9)
3rd year, *n* = 40 (*32%*)	2.1 (1.8, 2.4)	3.3 (3.0, 3.7)	2.8 (2.4, 3.2)	2.2 (2.0, 2.4)	3.7 (3.4, 4.0)	3.8 (3.5, 4.1)
Diff. between academ. years	$p = 0.71$	$p = 0.95$	$p = 0.42$	$p = 0.13$	$p = 0.13$	$p = 0.47$

S-1, school-1; S-2, school-2; CI, confidence interval; SCL, symptoms check list; BAS, body appreciation scale; RSS, Rosenberg self-esteem scale; CAPS, children and adolescent perfectionism scale; SOP, self-oriented perfectionism; SPP, socially-prescribed perfectionism; RSA, resilience scale for adults.

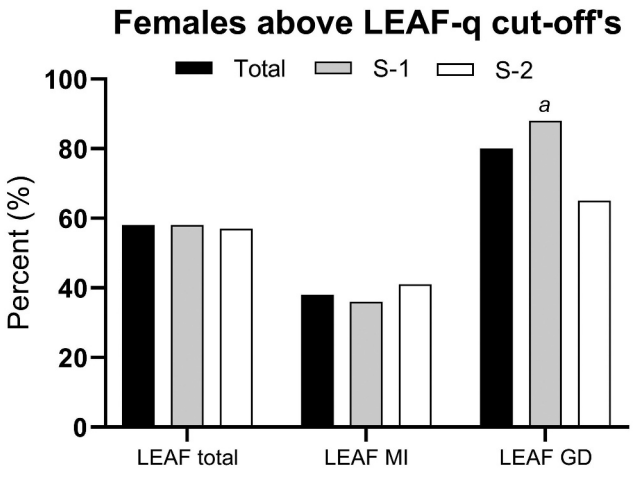

Figure 2. The percent of the total female sample and of females from the two schools separately, who scores above cut-off for LEAF-total, LEAF-MI and LEAF-GD. NOTE: LEAF, low energy availability for females; MI, menstrual irregularities; GD, gastrointestinal dysfunction; S-1, school-1; S-2, school-2, *a, significant difference between schools, p = 0.005*.

Menstrual health

In total 40 (36%) females reported not to use any hormonal contraceptives, with no differences between schools or academic year. Among those without hormonal contraceptives, the number without normal menstrual cycle (i.e. symptoms of amenorrhea) was 13 (33%). There were no differences between schools or academic year with regards to use of hormonal contraceptives or symptoms of amenorrhea.

Injuries

In total 67 (54%) of the dancers reported to have had an injury more than once the current year, depriving them from participation in physical classes and training. This corresponded to 9 (64%) of the males and 58 (53%) of the females. There was no difference between sexes or schools, however, there was a difference according to academic year: 14 (30%) in 1st year, 16 (42%) in 2nd year, and 28 (70%) in 3rd year ($p = 0.002$). The most frequent injuries were muscle/tendon inflammations (36%) and muscle strains and sprains (27%), followed by joint injuries (spine, hips, knee, ankles) (21%), illness (11%), fractures (3%), and fatigue (2%).

In females, we evaluated whether training volume, symptoms of amenorrhea, academic year, BMI, LEAF-q, BAS-2, EDE-q or age could explain the likelihood of injuries. A significant model included BMI with OR = 1.39 (99% CI: 1.0, 1.9), academic year with OR = 2.86 (99% CI: 1.3, 6.2) and LEAF-q score with OR = 1.33 (99% CI: 1.1, 1.6), and had a specificity of 71% and sensitivity of 85%, hence, an accuracy of 78% ($p < 0.001$). The corresponding analysis in males, did not result in any significant model.

Table 3. Symptoms of eating disorder (EDE-q). EDE-q scores are presented for the total sample, and samples distributed by schools and academic year. Results are median (range).

Participant	EDE-q global score	EDE-q bodyweight concern	EDE-q figure concern	EDE-q eating concern	EDE-q eating restriction
Total, *n* = 124	1.3 (4.9)	1.6 (6.0)	2.1 (5.9)	0.4 (4.4)	0.8 (5.0)
Females *n* = 110	1.4 (4.9)	1.6 (6.0)	0.8 (5.0)	0.4 (4.4)	2.4 (5.9)
Males *n* = 14	0.4 (2.7)	0.5 (4.2)	0.3 (2.6)	0.1 (0.6)	0.8 (4.4)
Diff between sexes	*p* = 0.010	*p* = 0.017	*p* = 0.12	*p* = 0.03	*p* = 0.010
Schools					
S-1, *n* = 77 (*62%*)	1.4 (4.5)	1.8 (6.0)	2.5 (5.9)	0.4 (4.4)	0.8 (5.0)
S-2, *n* = 47 (*38%*)	0.9 (4.9)	1.0 (5.6)	1.8 (5.8)	0.2 (4.2)	0.6 (4.4)
Diff. between schools	*p* = 0.027	*p* = 0.040	*p* = 0.019	*p* = 0.279	*p* = 0.165
Academic year					
1st year, *n* = 46 (*37%*)	1.3 (4.9)	1.8 (5.6)	2.4 (5.8)	0.3 (3.8)	0.8 (5.0)
2nd year, *n* = 38 (*31%*)	1.2 (4.5)	1.4 (5.8)	2.1 (5.9)	0.4 (4.2)	0.7 (3.4)
3rd year, *n* = 40 (*32%*)	1.3 (4.5)	1.2 (6.0)	2.0 (5.5)	0.3 (4.4)	0.6 (4.2)
Diff. between academ. year	*p* = 0.672	*p* = 0.512	*p* = 0.480	*p* = 0.835	*p* = 0.954

S-1, school-1; S-2, school-2; CI, confidence interval; EDE-q, eating disorder examination questionnaire.

Eating disorders and symptoms of eating disorders

The results on EDE-q are presented in Table 3. There was a statistically significant higher total score in females compared to males, which was mainly due to a higher score in the subscale eating restriction (see Table 3). The total numbers above EDE-q cut-off, and numbers above clinical cut-off for binge eating or ~~any~~ purging behaviour (i.e. disordered eating behaviour), are presented in Figure 3. The most frequent purging behaviour was driven exercise (EDE-q 18), practiced by 64 (52%) of the total sample. None reported use of laxatives (EDE-q 17), while 6 (5%) of all participants reported purging by self-induced vomiting (EDE-q 16). There were no differences between sexes, schools or academic year in numbers above EDE-q global score cut-off, clinical cut-off for binge eating, or clinical cut-off for purging behaviour.

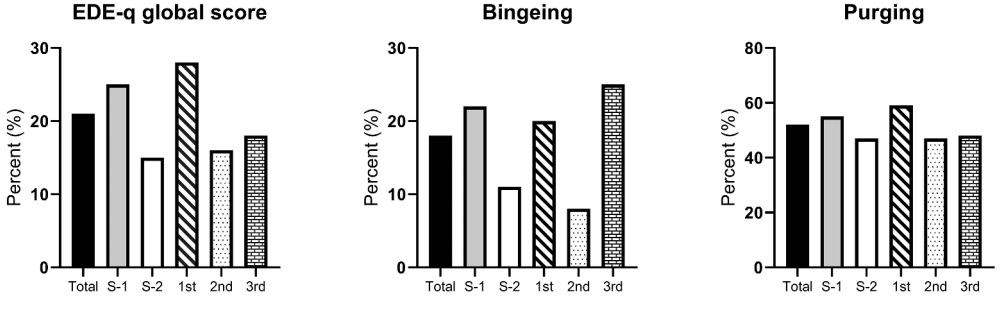

Figure 3. The percentage of total student sample, of students sorted by schools, and students sorted by academic year, who scores above clinical cut-off in EDE-q global score, binge eating behaviour, and purging behaviour. NOTE: S-1, school-1; S-2, school-2, 1st, 1st year students; 2nd, 2nd year students; 3rd, 3rd year students; Bingeing, ≥4 binge eating episodes with loss of control last 28 days (EDE-q-14); Purging, ≥4 purging episodes last 28 days (EDE-q-16-18).

In the total sample, 15 (12%) self-reported a history or presence of a diagnosed eating disorder, with 5 (4%) reporting a diagnosis of AN, 1 (1%) a diagnosis of BN, 5 (4%) reporting fluctuations between AN and BN, and 4 (3%) did not report the specific diagnosis. No differences were found between sexes, schools or academic year.

Self-awareness of mental health

In total 63 (51%) responded positive on the question asking whether the student knew how to take care of their own mental health, with no difference between sexes, schools or academic year. Additionally, 56 (45%) of the total sample wanted to ask for professional help if in need. There was no difference between sexes or schools, but a significant increased interest for consulting professional help with advancement in academic year: 13 (28%) from 1st year, 18 (47%) from 2nd year, and 25 (63%) from 3rd year ($p = 0.006$).

Explanation for variability in EDE-q, in LEAF-q, and in SCL-10

We evaluated whether self-esteem (RSS), body appreciation (BAS-2), resilience (RSA), and self-oriented perfectionism (CAPS-SOP) could explain the likelihood of scoring above EDE-q cut-off. A significant model included BAS-2 only, with odds ratio = -3.33 (99% CI: 0.0, 0.2), and had a specificity of 96% and sensitivity of 60%, hence, an accuracy of 89% ($p < 0.001$).

We also looked for explanations for the variability in LEA in females. The impact by dance style, symptoms of eating disorders (EDE-q), age, regular breakfast and – evening meal consumption, school, and by training volume were evaluated as explanations for the variability in symptoms for LEA (LEAF-q). The best fit model identified the EDE-q global score (standardized $\beta = 0.27$, 99% CI [0.12, 1.72]) and training volume (standardized $\beta = 0.22$, 99% CI [-0.01, 0.16] to account for 15% of the variation in LEAF-q (F [2,133] = 9.0, $p \leq 0.001$).

Finally, explanation for the variability of symptoms of anxiety and depression (SCL-10) was explored separately by sex; evaluating the impact of symptoms of eating disorders (EDE-q), resilience (RSA), self-oriented perfectionism (CAPS-SOP), socially prescribed perfectionism (CAPS-SPP), body appreciation (BAS-2), self-esteem (RSS), and age. Only in females there was a significant model, explaining 44% of the variation in SCL-10 (F[2, 106] = 44.0, $p < 0.001$, with CAPS-SOP (standardized $\beta = 0.36$, 99% CI [0.16, 0.56]) and RSS (standardized $\beta = 0.42$, 99% CI [0.26, 0.78] as significant variables.

Discussion

This cross-sectional study of Norwegian professional male and female dance students aimed to explore the frequency and intensity of mental health challenges, LEA and injuries, and to find explanations for such symptoms. In addition, awareness of personal mental health symptoms, differences between sexes, performance level, and academic year, were also investigated. The results reveal that 20–60% of the dancers had symptoms of anxiety or depression, symptoms of LEA, and/or symptoms of eating disorders and

disordered eating behaviour, and 12% reported to have had an eating disorder diagnosed by a health professional. Additionally, 50% reported injuries that deprived them from participation in physical dance classes and training.

Considering the medium to strong effect sizes, males seemed to perform better than females in symptoms of eating disorders, eating restriction, body acceptance, and symptoms of anxiety and depression, still only resilience was significantly better in males compared to females. Females on the other hand, had significantly higher self-esteem compared to males. There were few differences between schools (i.e. performance level), other than a higher BMI, fewer training hours, and more symptoms of gastrointestinal disturbances in S-1 (lower performance level) compared to S-2 (higher performance level). According to academic year, progression in studies resulted in higher frequency of injuries, concurrently to a lower barrier towards professional health consultations.

Mental health symptoms, self-esteem, and body appreciation

The prevalence of depression and anxiety symptoms in the current study are higher than previously reported among ballet dancers (Nascimento, Luna, and Fontenelle 2012) or dancers of mixed genres (Liu et al. 2016). In females, 44% of the variability in such mental health symptoms was explained by self-oriented perfectionism and self-esteem. While the association between perfectionism and anxiety is known (Bardone-Cone, Lin, and Butler 2017), the negative effect from high self-esteem was not expected. Considering the early initiation of dance career (Table 1), it may be reasonable to suggest that these females have evolved a global self-worth relying on their dance performance and the feedback they received at early age. As such, relying on a higher self-esteem and putting high performance standards to themselves, a result of mental health symptoms is reasonable if expectations are not met and rivalry amongst the best is tough (Bardone-Cone, Lin, and Butler 2017). Concurrently, the level of body appreciation was low in the current sample, considering having a group that in the future will as a living rely on their physical and artistic performance, and as such, should be focused on body functionality. Being physically active is argued to reinforce a sense of embodiment, including physical power, positive body awareness and responsiveness, and physical competence, hence, potentially enhancing a positive body experience and appreciation, and also self-esteem (Menzel and Levine 2011; Lemoine et al. 2018). Nevertheless, the results on body appreciation in this highly physically active sample did not diverge from previous findings among non-dancing adolescent and young male and female adult samples (Lemoine et al. 2018), nor a female university sample (Alleva et al. 2016). Attenuated scorings in body appreciation may be a result of complying with a culture in which there are strong expectations for a certain body figure presentation and continuous expectations for enhanced performance. As such, our findings might reflect an insatiable drive for improvement in body functionality (i.e. self-oriented perfectionism), making it hard to experience joy and appreciation (i.e. low body appreciation tempering the self-esteem), resulting in high frequency of symptoms for depression and anxiety.

Meal frequency, symptoms of low energy availability, eating disorders, and injuries

While the majority ate regular meals during early daytime, only 40% reported regular evening meals, and less than 50% reported regular recovery- or snack meals. This contrasts to the high volume of physical activity, which not only presuppose sufficient energy intake to tolerate and adapt to such regimes (Logue et al. 2020; Mountjoy et al. 2018), but also a balanced energy intake throughout the day (Logue et al. 2020). A poor match of energy intake and proper energy distribution throughout the day, with energy consumption, results in LEA. This is a scenario increasing the risk of relative energy deficiency in sport (RED-s) (implying high risk of poor training adaptions and recovery, illness, injuries and impaired mental health) (Mountjoy et al. 2018). Confirming this, is the frequency of symptoms of LEA in the female dancers by 58%, which is also more frequent than previously reported in a mixed group of dancers (Robbeson, Kruger, and Wright 2015) and in professional ballet dancers (Staal et al. 2018), still comparable to what have been found in vocational female ballet students (Civil et al. 2018). The latter study did also find comparable levels of amenorrhea (40%) (Civil et al. 2018), corresponding to a prevalence of 33% in the current study. Symptoms of disordered eating (EDE-q) and training volume combined were explaining 15% of the variability in LEA in the current study. The high prevalence of injuries among these dancers further underlines the impact from LEA, with an increased odds ratio of having an injury with increasing BMI and advancing academic year, and if symptoms of LEA was prevalent. Our finding on prevalence of injuries, and specifically the explanatory value of BMI, matches perfectly to what recently was reported in a group of contemporary dance students (van Winden et al. 2020a, 2019). Injuries deprive the dancers from training participation, hence halting their professional development and impairing their performance level. Additionally, the high number of injuries are of great concern, because of the related psychological distress that may occur (Leddy, Lambert, and Ogles 1994; Mainwaring and Finney 2017).

Totally 12% of the dancers reported that they had been diagnosed with an eating disorder by a health professional of eating disorders, and we identified 20% to currently have symptoms of such. Additionally, 20% reported frequent episodes with lack of control of eating, and 52% were practicing driven exercise (i.e. feeling compelled to exercise in fear of gaining weight). The prevalence of self-reported diagnosed eating disorders is slightly lower than previously reported in mixed-groups of dancers by clinical interviews (Liu et al. 2016) and in ballet dancers (Arcelus, Witcomb, and Mitchell 2014), but comparable to the self-reported prevalence in collegiate majors in modern dance (Friesen et al. 2011; Arcelus, Witcomb, and Mitchell 2014). With the current study, investigating symptoms of eating disorders in a group of young adults representing various dance genres, and the ability to split on sex; novel information is provided to the field. Few previous studies have included males, and most have presented adolescents samples. Still, one previous study on Brazilian professional ballet dancers including both sexes, found no difference between sexes on symptoms of eating disorders by the Eating Attitude Test (EAT-26) and the Bulimic Investigatory Test (BITE) (Ribeiro and Da Veiga 2010). In the current study, a high body appreciation reduced the likelihood of having an eating disorder (i.e. scoring above EDE-q cut-off), with an odds ratio

of -3.33. Contrarily, by not accepting and embracing their own unique physical abilities, and caring enough for their bodies, several dancers seem to push their limits by trying to control body weight beyond their genetic disposition or with improper methods.

Awareness of personal mental health

Among professional dance students there seems to be a low mental health literacy, as about half of the dancers reported to be aware of symptoms for personal mental health challenges. Still, only 45% in the total sample were willing to consult a health professional if in need. This finding replicate what has previously been reported from dancers of diverse performance levels, and points to a need for increased health literacy (Alimena and Air 2016; Alimena et al. 2016). Importantly, the willingness to consult help, progressed with academic progression, which also coincided with the increased frequency of mental health challenges. The increased willingness to consult help may be a positive effect arising from the academic theoretic curriculum, or ultimately a choice after a long period with suffering. Nevertheless, this implies a need to increase the acceptability of mental health symptoms earlier on, and to increase the acceptability for professional mental health care, to reduce the clinical severity before reaching out for help.

There were few differences between schools, but students at school-1, in which pedagogical subjects were part of the curriculum, were heavier compared to students at school-2, were training less, were more concerned about body figure, expressed less resilience, and had more symptoms of gastrointestinal dysfunction. Importantly, there were more males in school-2 compared to school-1, and males scored better in resilience compared to females. As such, differences between schools could be explained by the uneven distribution of males, who seemed to do better in psychometrics outcomes. Repeating the analyses between schools solely based on females, the differences in resilience and figure concern disappeared, still differences in BMI, volume of training, and symptoms of gastrointestinal dysfunction remained.

Strengths and limitations

Inviting almost the whole cohort of professional male and female dance students, with high response rate, and use of validated questionnaires, brings credibility to these findings.

Limiting the interpretation of these findings, are the lack of clinical interviews. Further, considering the high frequency of mental health challenges, and low willingness to consult a health professional, it is unfortunate that we did not directly examine how many that currently were under mental health consultation. Finally, considering the small sample of males compared to females, the differences identified, should be considered with some caution.

Conclusion

This cross-sectional study identified a high prevalence of mental health challenges and injuries in professional dance students, and low mental health literacy. Our results indicate that increased body appreciation, proper nutritional knowledge to cover basic

needs, to increase performance and to aid in body weight regulation is needed, and that mental health awareness and literacy is critical to reduce mental health challenges, LEA, disordered eating and high frequency of injuries. Development and evaluation of targeted interventions is required, and schools need to incorporate such priorities in their curriculum, including training of employees, to defeat injury frequency and mental health challenges.

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