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The Physical and Psychological Effects of Ballet on Adolescents

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ABSTRACT

Background: Ballet is a traditional dance form that involves intense physical stress including large leaps, turns and jumps all performed to classical music. Beyond the physical demand and effects, ballet dancers also are impacted psychologically through their training. While there exists a lot of research on the effects of ballet dancing on professional dancers, the research done for adolescent ballet dancers in recreational and pre-professional settings is limited. Given that novice commitment in classical ballet training has grown and the dance form has become available as a physical and social activity for all age groups, it is important to better understand the effects of ballet training on these nonprofessional populations.

Aim, Subject and Method: This narrative literature review aimed to find the physiological and psychological effects of ballet training both recreational and pre-professional, on adolescent dancers. The literature revealed important findings on ballet training's effects on bone mineral density, body composition, timing of menarche, balance, flexibility, injury, psychological resilience, personality and body image.

Results: Both recreational and preprofessional ballet training were seen to possibly decrease body fat in dancers, increase lower limb bone mineral density (BMD) in weight bearing sights, improve balance and increase flexibility. It was found that pre professional ballet dancers had lesser arm BMD as compared to controls. The proportion of overuse injury was higher in recreational settings than pre-professional settings.It was also found that both populations had a greater sensitivity in recognizing emotions and were more resilient as compared to controls. Dancing was seen to possibly contribute to harmful attitudes towards pain, body image and weight control in pre-professional settings.

Conclusion: Physiologically, it has been found that ballet can enhance lower limb bone mineral density, flexibility, balance and body composition, yet may also lead to upper limb BMD deficits and risk of injury. Psychologically, ballet has been found to promote resilience and emotional attunement. It may also contribute to harmful attitudes towards pain, body image and weight control for pre-professional dancers.

INTRODUCTION

Ballet is a traditional dance form that can often exceed anatomical limitations encompassing large leaps, turns and jumps, often performed to classical music (Kenny et al.,2016). Ballet often focuses on maintaining aesthetically pleasing lines while performing in order to please audiences that watch. As a result, pressure can be put on dancers to maintain a slim physique to attain such expectations (Adam et al.,2004). Novice commitment in classical ballet training has grown over time and the dance form has become available as a physical and social activity for all age groups as it has been found to improve metabolism and benefit physical functioning. (Rodrigues-Krause et al.,2019).

A narrative literature review was performed using 35 peer reviewed journal articles that included systematic reviews, meta-analysis, observational studies, qualitative studies and literature reviews. Databases were searched for the articles including PubMed, SPORTDiscus, PsycINFO and Google Scholar.Keywords included but were not limited to: ballet, dancer, physical, physiological, psychological, adolescents, recreational, pre-professional. All retrieved articles were screened based on whether the results were applicable to professional, preprofessional or recreational settings of ballet dancing. A complete summary table of the studies reviewed can be found in the appendix.

For the purpose of this paper, ballet dancing was divided into three distinct populations of recreational (1-6 hours of training a week or not looking to dance professionally), pre-professional (7-15 hours of training a week or dancers preparing for a career in dance) and professional dancers (16 or more hours of training a week and dancing as a professional endeavor). It is very possible that there are important differences between these populations, which is why it is important to address their findings separately and generalize one for the other with caution.

PHYSICAL EFFECTS OF BALLET

Bone Mineral Density

Bone Mineral Density(BMD) in adolescents is a crucial time of bone development, in which the bone's highest mass is reached in women at the age of 19(Burkhardt & Brennan, 2012). For pre-professional female dancers around ages 15-19, BMD was seen to be higher in weight-bearing sites (like femoral trochanter, femoral neck and Ward's triangle), but lesser in upper limbs (the radius) as compared to the controls according to a meta-analysis on BMD (Wewage & Ward, 2018). Studies that explored the effect of ballet training on the lumbar spine gave mixed results. One study comparing the BMD of adolescents participating in sports that cause impact loading on the skeleton found that gymnasts and dancers had the same BMD in the lumbar spine as compared to age matched controls in low impact sports such as swimming (Grimpston et al.,1993). A review found inconclusive results of the BMD in the lumbar spine in female ballet dancers (Hewett & Tufano,2015). A three-year longitudinal study focussing on the effect of 2-4 hours of recreational ballet and modern dance in a week found that the 11- to 14-year-old girls showed 4% more BMD in the femoral neck than controls did (Matthews et al.,2006), which is in line with the data of increased BMD for pre-professional dancers.

Randomized control trials that assessed the osteogenic effects of jumping exercises supported the idea that due to osteoprotective effects that happen on load bearing sights, ballet dancers had high BMD in the lower limbs (Fuchs et al., 2001). This is the effect of loading in the lower extremities and trunk as ballerinas can experience three times their body weight of force from the ground.(McNitt-Grey et al.,1992) This positive effect of ballet on increased lower limb BMD in adolescents is supported by research that found that young dancers starting pre-professional training had lower total BMD than controls (Amorim et al., 2017) but as seen in the systematic review by Wewage and Ward (2018), pre-professional dancers in later adolescents had higher lower limb BMD than controls, indicating an increase in lower limb BMD through training.

Bone Mineral Density and Chronic Energy Deficiency

The term "relative energy deficiency" in sport is the disparity in daily energy intake and energy usage.(Mountjoy et al., 2014) . Chronic energy deficiency" is a pathological state of low body weight and depleted energy stores resulting from long periods of food deprivation, unbalanced nutritional intake and a constant mismatch between energy consumption and expenditure that can lead to lower BMI and impair growth (James et al.,1988). "Chronic energy deficiency" is a condition often seen in aesthetic sports like ballet that can have physiological consequences like decline in bone health or increase in stress fractures in trying to maintain a lean body shape (Chen et al., 2013). Young et al. (1994) hypothesized that compromised BMD was due to low energy availability. Further,Wewage and Ward (2018) found that ballet dancers had lower BMI than age-matched controls suggesting that dancers BMD would have been higher if the BMI had been higher, despite the bone strengthening effects of ballet training. This could be a reason for ballet dancers to have lower BMD in the upper limbs. However, the samples in this research were from professional or pre-professional populations and further research is needed to replicate these findings among recreational ballet dancers.

Bone Mineral Density and Delayed Menarche

Due to strenuous training and weight control, female elite adolescent dancers can experience menstrual disorders (Liu et al.,2024). An inverse correlation was found between age at menarche with arm BMD and total body BMD. The first two years of menarche play a vital role in BMD accumulation. Studies have shown delayed menarche in young ballet dancers (Steinberg et al.; Abraham et al., 1982). According to Chen et al. (2009) dancers are at risk of having lower BMD during adulthood if they are impacted by late menarche. As a result, one could speculate that late menarche could be a reason for female dancers having lower BMD in their arms which does not seem to affect lower limbs due to repeated weight bearing on those areas. Therefore, it may be the case that adolescent dancers could be at the risk of lower BMD in their arms if they carry out weight control behaviors even during arduous training and also due to delayed menarche. Abraham noted that ballet dancers faced menstrual irregularities, amenorrhea despite no significant weight changes and over periods of time when the dancers were prevented from dancing for longer periods of time due to injury or holiday (8 weeks), menstrual irregularities reduced. (Abraham et al., 1982).

However, there is conflicting evidence in a study by Steinberg et al. (2008) that found a very minimal

delay in menarche for dancers aged 8-16 when they practiced 2 hours a week and greater depending on their age. In the study, sixteen-year-olds practiced up to 11 hours a week. Therefore, while elite adolescent dancers may experience a greater delay in menarche, this may not always apply to dancers that put fewer hours of their week into training.

Balance

Balance is the ability to hold a position steady without much movement, its dynamic form requiring the ability to perform a task in that same position (Winter DA et al.,1990). A systematic review observed the difference in balance of dancers when comparing them to controls. After viewing the capabilities of professional, pre-professional and recreational dancers, it was seen that those with more experience had better balance with their eyes open. However, this was only limited to exercises that were prevalent in classical ballet given that the dancers showed worse balance with their eyes closed compared to controls. This indicated that dancers were more dependent on their vision than controls, regardless of their experience (Rangel et al.,2020). It can be inferred that dance can have a positive effect on the balance of adolescent dancers in the eye open condition that gets better with experience.

Body composition

A systematic review found mixed results regarding the changes in body composition of ballet dancers after training(Shaw et al., 2021). Considering that all the studies in the review had different aged participants and time intervals, the results of the effect are not consistent. Three groups with decreased fat percentage after varying time of doing ballet (Da Silva et al.,2015; Pigeon et al.,1997; Micheli LJ et al.,2005) were observed. A study examining pre-professional ballet dancers aged 12 to 15 years old for 17 weeks, measured their body composition before and after the period in which they took part in 10 hours of training a week (Da Silva et al.,2015). The results found that all 25 adolescents had a significant increase in body mass, corresponding with a decrease in their body fat. Conversely, a longitudinal study over 5 years found that adolescent ballet dancers training at a conservatoire experienced loss in their body mass and were slimmest compared to adolescents who did train in other sports for the same amount of time (8 hours per week; Pigeon et al.,1997). However, the findings suggest that this weight loss was related to weight control behaviors (Pigeon et al.,1997). Therefore, this may not be a result of the physical ballet training but rather the culture and environment of a pre-professional conservatoire. Further it needs to be considered that in the Da Silva et al. (2015) paper that was first discussed, the initial readings of their body composition were done after a 20-day resting period.

Therefore, their increase in body mass may have been due in part to a possible decrease in mass during the resting period. Together, these findings are supported by research that found differences between preseason and postseason body composition of professional female ballet dancers aged 17 to 32 (Micheli LJ et al.,2005). Specifically, the professional ballet female dancers reported decreased body weight and percentage of body weight as fat.

However, the findings above should be interpreted with caution, as important confounding factors may have played a role. For example, it is unknown what level of dancers were included in the Da Silva et al.

(2015) paper, but given that the dancers had only 5 or less years of experience, this may have impacted the findings on body mass increase for dancers.(Letton et al, 2020). On the other hand, Pigeon et al.(1997) study was done in a conservatoire, which could indicate that these dancers were more experienced and of higher level. One could analyse that because the study that was less intensive had an increase in body mass(specifically muscle mass) than in more professional settings, loss in body mass was more common either because of the intensive training, weight loss behavior or already great amount of muscle from previous training. Then again, the gain in weight could have happened due to the resting period time given to the dancers beforehand. Finally, although the Micheli et al. (2005) paper found differences for female ballet dancers between pre- and post-season, they did not find any differences in body composition in male dancers. Therefore, there may be important gender differences to consider in the effect of ballet training on body composition.

All three (Pigeon et al.,1997; Micheli LJ et al.,2005; Da Silva et al.,2015) studies showed a decrease in body fat in dancers' durations of 8 hours dancing a week, a ballet season and 10 hours a week respectively. It can be concluded that ballet may decrease body fat. Since this applies to pre-professional adolescent dancers with 5 years of experience, it could also apply to those in the same age group who dance recreationally.

Further, studies that examined the difference between dancers and non-dancers found similar results. A study found that aspiring professional ballet dancers in the age group of 10 to 15 years that danced around 15 hours a week showed lower BMI and Body Fat Percentage than controls(Grochowska-Niedworok et al., 2018). Additionally, a study found that ballet dancers aged 11-16 had a lower body mass as compared to non-dancers(Steinberg et al., 2008). When comparing the BMI of pre-professional dancers and age-matched controls, a meta analysis found that they were in the 19th and 55th percentile (Wewage & Ward., 2018) which meant that they were within the normal weight range. However, Steinberg et al. (2008) also suggested that differences in physique of professional dancers may not have been primarily due to the training they undergo but due to children selected to do ballet programmes based on their body type.

Flexibility

Classical Ballet Dancers have been seen to have greater flexibility than the normal standards, especially in their lower limbs. Hip external rotation is specifically crucial for performing ballet because it allows dancers to carry out the “turnout” position on which ballet technique is based(Sawers et al.,2015). Some areas in which ballet dancers are more flexible than non dancer controls include passive hip external rotation, knee extensions,spine, hamstrings, flexion and abduction as well. It is suggested that these trends are the effect of the ballet exercises given that the tendency to have these traits increases with experience (Reid et al.,1987). A study by Kadel et al.(2005) found that dancers aged 8-13 years who danced at least 1.5 hours, 3 times a week, having done so for at least a year when compared to aged matched controls were more flexible. The dancers had better flexibility in all six of Nicholas’ Flexibility Tests including elbow hyper extension, external arm rotation, lotus position, external hip rotation, knee recurvatum and palms to floor. Given that young ballet dancers had greater than normal flexibility and since increase in

years of experience also has positive effects on the same, it can be inferred that recreational ballet dancing even from a young age, can improve the flexibility of dancers.

Injury

Twitchett et al.(2009) found that ballet dancers may have underdeveloped physical parameters as compared to other sports that may make these dancers more prone to injury due to poor alignment when landing and when exposing their body to harmful rotational forces. A study done by Allen & Wyon (2008) found that dancers don't have the same physical fitness to rely on if they make mistakes in their skill (which may be due to fatigue) as there would be for others participating in intermittent sports. A systematic review found that 1.24 injuries take place every 1000 hours of ballet for professional ballet dancers while amateur ballet dancers experience .97 injuries for the same. Recreation dancers were also found to have a greater number of overuse injuries than professionals(Smith et al.,2015). Further it was found by Rizzardo et al.(2018) that young ballet dancers are more prone to getting injured during their time around puberty due to this period coinciding with their skeletal development. Therefore, while statistically more injuries take place in professional settings, adolescent dancers may still be at risk of overuse injury or injury during puberty.

Psychological Effects of Ballet

Resilience

As ballet dancers start dancing at a young age, while musculoskeletal development is taking place, psychological identity formation happens alongside (Choudhury et al.,2025). As a result of the inevitability of pain, dancers' perception of it becomes that of how it is perceived in ballet culture (Paglion et al.,2023). A ballet dancer's complicated relationship with dance in which they are impacted mentally, physically and emotionally requires them to have certain coping mechanisms (Pickard, 2012). One such mechanism is brushing off injuries even in risky situations in order to prioritize performing, persevering through pain (Paglione et al.,2023). It was found in a study by Choudhury et al. (2025) that ballet dancers experiencing pain trained more compared to those that didn’t experience as much pain for it was hypothesized to be evidence for belonging within the dance setting. Enduring pain becomes a prerequisite for maintaining a ballet dancer's identity and achieving their goals as a dancer. The dancers in the study by Choudhury et al were in the age group of 10-18 years with 14% low, 64% moderately and 23% highly specialized dancers. Since the findings applied to ballet dancers of variable expertise, it can be deduced that adolescent dancers, whether they are professional or amateur, may have similar qualities of resilience when experiencing pain. Therefore, resilience in ballet may be both detrimental to physical health as well as beneficial for psychological fortitude by perceiving pain as a sign of hard work and improvement (Wainwright & Turner,2003).

Body Image and Eating Disorders

Ballet is associated with the aesthetic ideal of thinness and grace and professional dancers can experience stress in trying to achieve the unrealistic dancer’s bodies (Dryburgh & Fortin, 2010). Professional ballet dancers have therefore seen to have shown psychological trauma and eating disorders after being deeply influenced by the dance environments (Kenny et al.,2019). The pressure from teachers, choreographers

and the desire to excel cause dancers to succumb to maintaining a slim figure from early ages (Batista et al.,2025). In a qualitative study done by Batista et al. (2025), dancers experienced weight related stress in their adolescent years. Compared to non-dancers, ballet dancers aged 11 to 16 were seen to show a less favored self-concept (Bakker, 1988). Meanwhile, late maturation leads adolescent dancers to feel anxiety in their social interactions and due to the uncertainty of the unknown outcomes of physical development to come. This is even though late puberty can be advantageous, allowing ballet dancers to conform to the expectations of a ballerina physique (Mitchell et al.,2020).

Emotional Sensitivity and Mood

Christensen et al. (2016) found that professional ballet dancers had a greater sensitivity in recognizing emotions as compared to non-dancer controls when shown videos of different emotionally expressive body movements(happy or sad). As this study tested professional dancers, the findings may or may not apply to recreational or pre-professional dancers. Therefore, further research is needed to include samples that are not only professional dancers.

On the other hand, research shows that recreational ballet dancers experience elevated mood and increased pleasure. For example, Kolb & Kalogeropoulou (2012) argued that while excessive training for a career of dancing can cause frustration, doing it just for enjoyment can relieve tension and increase self-confidence. This finding cannot be generalized to adolescent dancers and needs further investigation in a non-adult population. As such, there may be a difference between the experiences of those who dance for their profession from those who dance ballet as a hobby. Once again, more research is needed to examine if there is a differential effect of ballet on mood based on training level. Taken together, evidence suggests that professional dancers experience increased emotional sensitivity relative to non-dancers, while recreational ballet may improve mood and pleasure.

DISCUSSION

Overall research shows consistent findings for some physical health effects and inconsistent findings for other physical effects between recreational and pre-professional adolescent dancers. Both recreational and pre-professional ballet training were seen to possibly decrease body fat in dancers but mixed results made it hard to determine if this also corresponded with an increase in muscle mass. The increase in lower limb BMD in weight bearing sights such as the femoral neck was observed in both populations, however, while research has shown a decrease in arm BMD among pre-professional dancers, it has not yet been examined in recreational dancers. It was seen that dancers could be at risk of having lower BMD during adulthood if they are impacted by late menarche. It was suggested that late menarche could be a reason for female dancers having lower BMD in their arms, but contradictory evidence found no difference in menarche time for dancers who only trained two hours in the week which suggests these results of difference in menarche may not apply to recreational populations. There was no evidence present of chronic energy deficiency in the two populations while research shows that it was prevalent for professionals. As a result, the impact of stress fractures possible because of this also could not be determined. Greater flexibility (in

the passive hip external rotation, knee extensions, spine, hamstrings, flexion, abduction) and balance improvement was seen with more training but only in the eye open condition that suited the conditions of ballet since both populations of dancers were more dependent on their vision for balance. Whether injury was seen to be more prevalent in pre-professional settings as compared to recreational settings had inconclusive results, but the proportion of overuse injury was higher in recreational settings than pre-professional settings.

It was also found that both populations had a greater sensitivity in recognizing emotions when shown videos of different movements. There is some evidence that shows that both populations may be more emotionally resilient as compared to controls, persevering through pain as a coping mechanism of the constant mental and physical impact ballet training can have. It was found that ballet dancers can have a less favourable self concept and could be more introverted as compared to controls, especially for dancers in their later adolescent years(15,16yrs) but this study was dated from 1988 (Bakker, 1988).

The psychological wellbeing of a dancer was found to have a bearing on the physical health of ballet dancers as well. Negative dance stress was found to be a predictor of injury (Noh et al., 2011) but this was found in professional dancers so future research should replicate the same in a recreational and pre-professional setting. Both positive and negative results of ballet dancing were found for its psychological and physical effects on adolescents. More research existed on pre-professional ballet dancers as compared to recreational dancers.

Limitations and Future Research

A key limitation of this research was that ballet dance training is not operationalized in the same way. The participants in the studies were of varying ages, varying expertise, had different duration of ballet in the week and could have different intensity or skill level of ballet done in those sessions. While some studies explored dancers at conservatoire (Pigeon et al.,1997), others were in a ballet class. The literature revealed that ages of development were important for the difference in effects of ballet on the dancers. For example, it was found that the first two years of menarche are crucial in BMD accumulation (Chen et al., 2009) and women's highest bone mass is reached when they are around age 19 (Burkhardt & Brennan, 2012). It was difficult to establish how much training affected both flexibility and balance given there were differing dance times in the week for the participants in the studies. These differences could not be controlled or accounted for which is why when findings are generalized using the integration of multiple papers, results could be inaccurate.

More research and observational studies are needed to be done in recreational settings to determine if stress fractures are common, if low arm mineral bone density could occur, if menarche is significantly delayed for dancers (only one study found minimal difference), if fat decrease corresponded with muscle increase after training and if eating disorders are a common finding in this population.

CONCLUSION

The literature exploring the dance form of ballet both professional and recreational suggests that ballet training for adolescents has both benefits and challenges. This can depend on several factors such as the intensity and frequency of training as the research gave mixed results based on these differences. Physically, it has been found that ballet can enhance lower limb BMD, flexibility, balance and body composition ,yet may also lead to energy deficiency, menstrual disturbance, upper limb BMD deficits and risk of injury. Psychologically ballet has been found to promote resilience and emotional attunement but may also contribute to harmful attitudes towards pain, body image and weight control. This literature review is limited as it had to generalize many findings from professional settings to suit pre-professional and recreational settings. Future Research should be done on the psychological and physical effects of ballet training on recreational adolescent ballet dancers for while the literature had a lot on professional settings, not much was done in the context of ballet as a hobby.

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Appendix

Study / title	Study design	Sample	Country	Training level/population	Training exposure	Age	Sex	Outcomes measured	Main findings
Amorim et al. (2017) - Bone mass of Female dance students prior to professional dance training	cross-sectional study	64	Portugal	First-year vocational entry	First-year vocational dance	Not specified	Female	BMD, BMC	Young dancers starting pre-professional training had lower total BMD than controls
Chen et al. (2013) - Update on stress fractures in Female athletes	Review article	NA	USA	recreational, competitive and elite athletes	Not found	various ages	Female	stress fracture incidence, bone health BMD	Female athletes had higher stress fractures, low energy availability, poor bone health and menstrual dysfunction. Greater training volume associated with higher stress fracture risk.
Liu et al. (2024)- Low body fat percentage and menstrual Cycle Disorders in Female elite adolescent dancers	Cross-sectional observational study	131 dancers	China	Elite adolescent dancers attending a pre-professional dance school	2 hours and more	12-18 years	Female	BMI, BFP, Menstrual cycle irregularities, primary and secondary amenorrhea	lower BFP and menstrual problems
Steinberg et al. (2008)- Growth and Development of Female dancers	Cross-sectional comparative study	1708 dancers	Israel	nonprofessionals	2 hours or more	8 to 16 years old	Female	BMI, body proportions, fat distribution, age at menarche	Dancers had lower body weight; menarche occurred later in dancers

Study / title	Study design	Sample	Country	Training level/population	Training exposure	Age	Sex	Outcomes measured	Main findings
Abraham et al. (1982) - Body weight, exercise and menstrual status among ballet dancers in training	Prospective longitudinal study	29	Australia	professional ballet students	25 hours a week at least	15.5 to 18.7 yrs	Female	menstrual irregularities, amenorrhea despite no significant weight change	Strenuous exercise is more related to menstrual disturbances.
Rangel et al. (2020) - Studies of Classical Ballet Dancers' Equilibrium at Different Levels of Development and Versus Non-dancers: A systematic review	Systematic review of 9 cross-sectional studies	321 participants	multiple countries	recreational, pre-professional and professional dancers	Not found	12 to 39 years	male and Female	static and dynamic balance, postural stability, balance with eyes open vs closed	Performances are more physically demanding than classes; ballet alone may not be sufficient to improve aerobic fitness and muscular strength.
Shaw et al. (2021) - The activity demands and physiological responses observed in professional ballet: a systematic review	Systematic review of 9 cross-sectional studies	22 studies	multiple countries	professional ballet dancers	25 hours at least	male and Female	Female	physical workloads, jumps, plies, aerobic capacity, strength, flexibility, and body composition.	Performances impose greater physical demands than classes; ballet training may be insufficient to improve aerobic fitness and muscular strength
Da Silva et al. (2015) - The effects of 17 weeks of ballet training on the Automatic Modulation, hormonal, and general Biochemical Profile of Female adolescents	Longitudinal pre-post intervention study	24 ballet dancers	Brazil	high-level ballet preprofessional ballet dancers	average 15 hours a week, approx. 5 years of previous ballet experience	12-15 years	Female	body composition, hematological and biochemical markers	increased lean body mass, decreased relative body fat, ferritin and C-reactive protein decreased
Pigeon et al. (1997) - Intensive dance practice: repercussions on growth and puberty	Longitudinal controlled observation study	97 Female dancers with a control group	France	young Female dancers undergoing intensive ballet training	Not found	5-year follow-up	Female	height, weight, growth velocity, pubertal development and nutritional intake	Dancers were leaner and had poorer nutritional intake despite similar training. Puberty was delayed compared with controls
Micheli et al. (2005) - Preseason to postseason changes in body composition of professional ballet dancers	Longitudinal observational study	68 professional ballet dancers	USA	professional ballet dancers	Not found	Not found	Male and Female	body weight and body fat percentage	Female dancers showed significant reductions in body weight and body fat percentage.
Letton et al. (2020) - The effectiveness of classical ballet training on health-related outcomes: a systematic review	Systematic review of ballet training interventions	23 studies	multiple countries	experienced dancers and novice dancers	minimum 4 weeks	all age groups	male and Female	Physical and psychological health, particularly muscle strength and balance	Balance improved in 75 percent of studies assessing novice dancers; 25 percent of studies assessing muscular strength in experienced dancers reported improvement

Study / title	Study design	Sample	Country	Training level/population	Training exposure	Age	Sex	Outcomes measured	Main findings
Grochowska-Niedworok et al. (2018) - Study of top Ballet School students revealed large deficiencies in their body weight and fat	Cross-sectional observational study	150 Female ballet dancers	Poland	Professional students from elite ballet schools	17 +-3 hours a week	10-18 years	Female	BMI, Body fat percentage, body composition, physical activity levels, and menstrual history	Lower BMI than controls, mean menarche age 14.5 years. No significant association between physical activity levels and BMI or Body Fat
Sawers and Ting (2015) - Beam walking can detect differences in walking balance proficiency. Cross-sectional comparative experimental study across a range of sensorimotor abilities	Cross-sectional comparative experimental study	25 participants, 10 professionals and 10 untrained novices, 5 individuals with below-knee amputations	USA	professional ballet dancers	more than 10 years of training	adults over 18 years	Female	Balance	Dynamic walking ballet dancers demonstrated significantly better balance than novices on narrow and medium-width beams.
Reid (1988) - Prevention of hip and knee injuries in ballet dancers	Narrative review of ballet-related hip and knee injuries	NA	Canada	classic ballet dancers, including young and professional ones	not confirmed	13 - 19 years	male and Female	hip and knee injuries, external rotations, flexibility, muscular strength, and joint stress	large hip external rotation required for turnout is attributed to soft tissue adaptation, particularly in young dancers; insufficient hip rotation increases stress in knees and other lower limbs
Kadel et al. (2005) - Anthropometric measurements of young ballet dancers: examining body composition, puberty, flexibility and joint range of motion in comparison with non-dancers	Cross-sectional case-control study	86 participants	USA	young Female ballet students from a school	Not mentioned	Average age 13 yrs	Female	body composition, flexibility and joint range of motion	more flexibility in dancers; dancers have low body fat and lower body mass
Twitchett et al. (2009) - Physiological fitness and professional classical ballet performance: a brief review	narrative lit review	NA	Not found	professional classical ballet dancers	Not found	Not found	Not found	aerobic fitness, muscular strength, joint range of motion, body composition, injury risk and dance performance	Ballet dancers demonstrate greater than average hip ROM strength, but relatively weak upper body, torso, hamstrings and quadriceps; chances of increased injury risk associated with caloric restriction and low body weight and body fat

Study / title	Study design	Sample	Country	Training level/population	Training exposure	Age	Sex	Outcomes measured	Main findings
Allen & Wyon 2008) - Dance medicine: Artist or Athlete?	Narrative review of ballet-related hip and knee injuries	NA	United Kingdom	Not specified	not specified	Not restricted to adolescents		physical fitness, training demands, injury prevention, sports medicine and dance performance	Dancers are both artists and athletes. Dancers don't have the same physical fitness to rely on if they make mistakes in skill
Rizzardo (2018) - Is there a relationship between Female ballet injuries and maturation? A review	Narrative Literature review	NA	Canada	young elite Female ballet dancers	not specified	adolescents	Female	injury pattern, skeletal maturation, delayed menarche, menstrual irregularities	Adolescent ballet dancers experience frequent lower-limb and back injuries and are prone to injury around puberty
Smith et al. (2015) - Incidence and Prevalence of musculoskeletal injury in Ballet: A systematic review	21 studies	2265 dancers	multiple countries	amateur and professional ballet dancers	varied	Mean 16.2 amateurs, 27 years professional	Female and male	musculoskeletal injury incidence	amateur dancers had more overuse injuries than professional dancers
Choudhury et al. (2025) - The relationship between pain and athletic identity in youth ballet dancers.	Cross-sectional comparative study	44 ballet dancers	USA	Youth ballet dancers, low, moderate and high specialization	6 to 7 practices a week	10-18 years	Female	pain intensity, pain characteristics, athletic identity	stronger identification with dance over other roles and more negative emotions associated with poor performance
Paglione et al. (2026) - 'I guess you just have to deal with it': pre-professional ballet dancers' experiences of pain, injury, and social support.	Qualitative study	12 pre-professional dancers	Canada	summer intensive ballet program being attended by pre-professional ballet dancers	NA	11-19 years	Female	experience of pain and injury, perseverance, injury management	ignoring injuries and making risky choices, influence of ballet body ideals, self-assessment and self-management of injuries
Pickard, A. (2012) - Schooling the dancer: The evolution of an identity as a ballet dancer	longitudinal qualitative ethnographic study	12 ballet dancers	United Kingdom	young dancers attending non-residential ballet schools	not specified	10 -15 years	male and Female	Ballet identity, body image, physical and emotional suffering	Young dancers developed a strong ballet identity and learned to accept physical and emotional suffering as part of becoming dancers
Wainwright & Turner (2003) - Reflections on Embodiment and Vulnerability	review	Not specified	UK	not specified	not specified	adult ballet dancers	not specified	embodiment, physical vulnerability, injury, dancer identity	Ballet training shapes dancers' bodies and identities.

Study / title	Study design	Sample	Country	Training level/population	Training exposure	Age	Sex	Outcomes measured	Main findings
Dryburgh & Fortin (2010) Weighing in on surveillance: Perception of the impact of Surveillance on Female Ballet Dancer's Health	Qualitative study	15 professional dancers	Canada	not specified	not specified	not specified	Female	Psychological and physical health	Positive surveillance provided motivation; negative surveillance involved criticism, judgement and pressure to achieve an ideal body, was perceived as harmful to dancers' health
Junge, A., & Hauschild, A. (2025) - Prevalence of mental health problems and their potential association with sleep disturbance, coping skills and social support in professional ballet dancers	Prospective observational study with weekly self-reports	57 professional ballet dancers	Germany	professional ballet dancers from ballet companies	40 hours a week mean	Mean 28.1	male and Female	depression, anxiety, burnout, eating disorders	depression/low mood and anxiety reported, psychological problems
Batista et al. (2025) - My body is my business card	Qualitative study	10 professional dancers	Brazil	professional	NA	18 yrs plus	Female	body image, eating attitudes	Dancers described strong pressure to maintain slim bodies. Eating attitudes impacted by choreographers and teachers
Mitchel et al (2020)- Experiences of delayed maturation in Female Vocational Ballet students	Qualitative study (IPA)	28 dancers	UK	vocational ballet students from three ballet schools	not specified	not specified	Female	delayed puberty, body image, physical development	late-maturing dancers perceived advantages in retaining a smaller, more prepubescent physique matching ballet's aesthetic ideal
Christensen et al. (2016) - Dance Expertise Modulates Behavioral and Psychophysiological Responses to Affective Body Movement	Experimental comparative study	43 participants	UK	Professional ballet dancers	17.9 years of ballet experience	mean 24.85	Female	emotional sensitivity, psychological arousal	greater sensitivity in recognizing emotions as compared to controls
Kolb, A., & Kalogeropoulou, S. (2012) - In defense of ballet: Women, agency and the philosophy of pleasure.	Qualitative research	not confirmed	not confirmed	recreational ballet dancers	not confirmed	18 to 67 years	Female	enjoyment, pleasure, personal agency	ballet provided pleasure through physical movement
Bakker (1988) - Personality Differences Between Young Dancers and Non-Dancers	Cross-sectional comparative study using psychological questionnaires	52 ballet students	Netherlands	students attending a professional ballet school	mean 15 hours a week	11-16 years	Female	self-esteem, physical self-concept	ballet students had lower self-esteem, less favorable self-concept, more introverted than controls

Study / title	Study design	Sample	Country	Training level/population	Training exposure	Age	Sex	Outcomes measured	Main findings
Adam et al. (2004) - Psychological Factors Associated with Performance-Limiting Injuries in Professional Ballet Dancers	Cross-sectional correlational study using psychological questionnaires	54 professional ballet dancers	Germany, dancers represented 20 countries	Elite professional dancers	weekly training, hours not reported	mean 26 years	male and Female	perceived stress, mood states and performance-limiting injuries	stress related to meeting a certain physique, stress when periods of injury leading to negative mood states
Rodrigues-Krause et al. (2019) - Dancing for Healthy Aging: Functional and Metabolic Perspectives	randomized controlled trial and literature review	50 studies	Brazil	recreational and supervised dance program	intervention lasted 12 weeks, 3 sessions/ week of 60 mins each	over 55 years	male and Female	balance, gait, muscle strength, cardiovascular fitness, blood pressure	improvement in metabolism, balance most improved outcome
Young et al. (1994) - Bone density at weight-bearing and non-weight-bearing sites in ballet dancers: The effects of exercise, hypogonadism, and body weight.	Cross-sectional comparative study	44 adolescent dancers	Australia	Intensive ballet training	Not found	mean 17 years	Female	BMD, body composition	Higher or maintained BMD at weight-bearing sites, but lower BMD at non-weight-bearing sites. Reduced BMD had to do with low body fat and hormonal disturbances.
Noh, Morris, and Andersen (2005) - Psychosocial Factors and Ballet Injuries.	observational study	not found	not verified	ballet dancers, level not verified	not verified	adolescents	not verified	psychological factors, stress and ballet-related injuries	negative dance stress related to injury
McNitt-Gray et al. (1992) - Kinematics and Impulse Characteristics of Drop Landings from Three Heights	experimental biomedical study	30 participants	USA	professional dancers, landing mechanics	not reported	not reported	not confirmed	ground reaction forces	reported peak ground reaction force of approx. three times body weight