ASSOCIATION OF FEMALE ATHLETE TRIAD TO OTHER PSYCHO-PHYSIOLOGICAL PROBLEMS

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INTRODUCTION

The Female Athlete Triad is a common psycho-physiological problem often observed in highly trained female athletes as well as trained females conscious about physique. It showcases three main components:

- ❖ low energy availability with or without disordered eating,
- ❖ menstrual dysfunction and
- ❖ low bone mineral density (BMD) leading to Osteopenia and susceptible to stress fractures.

Various endocrinological, physiological and psychological problems associated with the Triad can lead to significant health disorders with time. To prevent and treat Sportspersons at risk or affected with the Triad, it is important to follow guidelines for early detection, prevention and treatment. Prevention tactics should focus on health education and counseling, regular screenings and medical support for athletes to increase health knowledge that could prevent the development of this syndrome. Female athletes should be able to keep track of their menstrual phases and address their physiological and behavioural changes (or patterns) associated with their rhythm. Introducing relevant nutritional, motivational and training changes accordingly can enhance the Athlete's overall performance.

LOW ENERGY AVAILABILITY and EATING DISORDERS

Disordered Eating involves disturbance in an athlete's diet or in the way one experiences their body, excessive or rigid exercise routine, obsessive calorie counting, anxiety about certain food groups and choosing a rigid approach to eating.

- ❖ Extreme weight loss methods, severe calorie and water restrictions combined with vigorous exercise, can lead to **disturbed eating behavior, anxiety, depression, and clinical Eating disorders(EDs)**.
- ❖ The continuous restrictive eating and malnutrition results in pervasive disturbances of most organ systems including **cardiovascular and gastrointestinal complications, endocrine disorders (i.e. osteopenia and amenorrhea) and other metabolic alterations**.

In **weight category sports**, the high prevalence of EDs most likely reflects the fact that many athletes want to have a low body fat mass and a high body muscle mass and compete in a weight class below their ordinary weight.

Athletes competing in sports that emphasize a lean body shape or a low body weight showed a significantly higher prevalence of eating disorder symptoms and clinically diagnosed EDs than others.

Female athletes (mainly in gymnastics, ballet, figure skating, lightweight rowing, and running) are at risk due to pressure to maintain a low body weight along with poor guidance about nutrition and weight loss.

High prevalence of EDs in endurance sports indicating a fear that extra body weight can limit performance.

Among female athletes, several different forms of harmful dieting is observed that includes restrictive behaviours, such as fasting, skipping meals, practicing dietary restraint, use of diet pills or laxatives, bingeing and purging.

- ❖ Athletes unknowingly fail to attain their energy requirements or lack of nutritional knowledge necessary to promote food intake as compensation for energy expenditure from intense exercise regimens which causes **Low Energy Availability (LEA)**.
- ❖ Wide spectrum of disordered eating that ranges from excessive dieting to clinical disorders such as **Anorexia nervosa, Bulimia nervosa, eating disorder otherwise not specified (EDNOS) and other prevalent psychiatric disorders** is often observed.
- ❖ Deficiency in macronutrients can affect body's ability to build bone, maintain muscle mass and repair damaged tissue. Thus, it is important to maintain a recommended diet plan with a proper ratio of macronutrients, micronutrients and roughage.

MENSTRUAL DYSFUNCTION in the Female athletes

- Menstrual dysfunction in the female athletes includes a wide spectrum of disorders:
- **Amenorrhea** (absence of menses 3 months, delay or early onset of menarche), **anovulation, luteal phase deficiency and Oligomenorrhea**. Amenorrhea that is caused by energy deficiency and stress is **Functional Hypothalamic Amenorrhea (FHA)**.
 - In amenorrheic athletes, decrease in fat mass and **Leptin deficiency** also contributes to the loss of menses.
 - The disruption of luteinizing hormone pulsatility while pituitary responsiveness to gonadotropin-releasing hormone is increased causes **amenorrhea of at hypothalamic origin**.

ALTERED ENDOCRINE FACTORS That affect sport performance:

- Nonsteroidal anti-inflammatory drugs (NSAIDs) taken for dysmenorrhea, affects airway resistance through prostaglandin inhibition and **cause menstrual-linked asthma or perimenstrual asthma**.
- **Therapeutic usage of hormones** for menstrual manipulation and withdrawal bleeding has unhealthy consequences.
- An increasing number of athletes use **Oral Contraceptive Pills (OCP)** for cycle control.
- **Hypoestrogenism** resulting from a suppression of hypothalamic pulsatile release of gonadotropin-releasing hormone (GnRH) and decline in the concentration of Luteinizing Hormone (LH) and Follicle Stimulating Hormone(FSH).
- **Abnormal Oestrogen (E) and progesterone (P) rhythms** alters energy substrate metabolism, thermoregulation, body water and electrolyte homeostasis, cardiorespiratory and metabolic parameters and makes the athlete prone to injury.
- **Hormonal changes due to FHA** includes:
 - Increase in levels of Neuropeptide Y, Ghrelin, Corticotropin Releasing Hormone, Cortisol and higher pulsatile amplitude of Allopregnanolone.
 - Lower levels of Serum Leptin, T3,T4, Insulin Growth factor-1, Blood glucose sugar.

Menstrual dysfunctions may override the positive effects of exercise on BONE HEALTH in young adults:

Bone strength, as a triad component, occurs along a spectrum that spans from low bone mass and stress fractures to osteoporosis, which is considered the most severe condition.

- ❖ The **greatest increase of bone mass** happens during puberty (11- 14 years). Young healthy women achieve 92% of their total body bone mineral content (**peak bone mass**) by 18 years and 99% by age 26 years.
- ❖ **Optimum consumption of Calcium, vitamin D, vitamin K and fish oil** is important for bone health (1300 mg of calcium and 600 IU of vitamin D daily). Bisphosphonates are not recommended for bone density as it can result in a potential teratogenic effect.
- ❖ In triad, **bone strength, bone microarchitecture, and bone remodeling** gets affected which results in low BMD ,stress fractures and osteoporosis. The process of **Bone turnover** (of bone formation and matrix development by osteoblasts and bone breakdown by osteoclasts) is **interrupted**, bone becomes weakened and prone to injury.

- ❖ **Weightbearing exercise** affects bone accrual and architecture. Amenorrheic athletes have overall lower BMD, 10% to 20% less lumbar spine BMD and 2 to 4 times greater risk for stress fracture than their eumenorrheic counterparts. Oligomenorrhea and amenorrhea (**hypoestrogenic states**) cause disruption of bone remodeling and accelerated bone resorption.

- ❖ **Resumption of menses cannot solve BMD issues immediately but gradual rebuilding of bone occurs** to decrease the risk of future osteoporosis and injury. Depending on the age of the athlete, duration of the triad, and time to recover, BMD may improve but not reach the normal levels.

Hormonal rhythm regulating Bone health in Female Athletes

Oestrogen is essential for epiphyseal fusion and contributes to gender differences in bone size. It inhibits osteoclast activity and increases osteoclast apoptosis (to ensure normal or controlled growth or development).The menopausal loss of oestrogen is the primary cause of increased bone turnover and remodelling imbalance.	Testosterone, like oestrogen decreases bone resorption and increases bone formation. During growth and modelling, it increases penosteal apposition (reduces bone fragility), which combines with the inhibition of apposition by oestrogen to cause the gender differences in bone size after puberty. Female bones have less strength high fragility.	Cortisol regulates bone turnover and contributes to the diurnal variation in bone turnover. It increases resorption and decreases formation by increasing osteoclast lifespan and induces osteoblast and osteocyte apoptosis and inhibiting osteoblast differentiation and function. High cortisol leads to a 'double hit' bone disease of increased resorption, decreased formation, decreased bone mineral density (BMD) and increased fracture risk.	Growth hormone and IGF-1 maintains bone geometry and BMD	Adipocyte hormones acts directly on osteoblasts to increase bone formation, which could contribute to the positive correlation between body weight and bone mass. It can increase bone resorption. Adiponectin have also been associated with BMD and bone turnover.	Gut, Pancreatic and Parathyroid hormones play a significant role in bone health of female athletes
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CONCLUSION

Female athletes are often dealing with low energy availability with or without eating disorders, functional hypothalamic amenorrhea, osteoporosis and random psychological problems alone or in combination to the other Triad components. An early intervention is essential to prevent its progression to serious endpoints that include long term clinical disorders and pose significant health hazards. Regularly menstruating female athletes do not need to amend for menstrual cycle to exploit performance instead they can receive multi-disciplinary professional help to improve their performance and recover from the Triad.

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