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The Impact of Menstruation on Psychological and Physiological Correlates of Endurance Performance

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Abstract – It is projected that menstruation has unenthusiastic belongings on physiological and psychological correlates of endurance performance. The physiological effects may be delicate, but at best level sufficient to manipulate performance. The psychological correlates may be affected more obviously and more detrimentally. The pace and the correctness of a perceptual decision depend on the strength of the sensory stimulation. When incentive strength is high, accuracy is high and response time is fast; when incentive strength is low, correctness is low and response time is slow.

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INTRODUCTION:-

Menstruation has become less of a barrier to achieving sports goals for women in recent times. Menstruation has historically been a taboo subject in sports science and in the coach-female athlete relationship, with embarrassment and lack of empathy from male coaches being prevalent. Despite abundant research addressing the effects of exercise on menstruation, including menstrual irregularities resulting from training, less is known about how menstruation affects women's athletic training and competition. These cyclic hormonal fluctuations may affect physiological, physical and psychological potential and ultimately impact on sports performance. The female athlete has a complex and continuously changing chemical mix of female steroid sex hormones, with individual, interactive and sometimes conflicting physiological responses (particularly on substrate utilisation, electrolyte and water balance, nervous system, blood sugar and circulation) with potential implications for athletic training . Early retrospective studies on the effect of the menstrual cycle on performances found a variety of responses. Lebrun's (2005) review of research found substantial differences in the effects reported by studies; from 8% to 69.7% of women found a decrement in performance during menstruation, while 13% to 43% had enhanced performance. The best performances were mostly during the immediate postmenstrual days, while the worst performances were in the pre-menstrual phase and during the first few days of the menstrual period. The most common reason for reduced performance cited in these studies was lethargy and fatigue, disrupted concentration and severely reduced levels of motivation. For elite female athletes even small differences in performance may be critical to athletic success. Changes in physiological parameters have been extensively reported in the literature at different phases of the menstrual cycle, including cardiovascular, haemodynamic, respiratory, metabolic, strength, biochemical and endocrine, but in general have not shown a consistent variation with specific phases. However, there is still a lack of understanding regarding women, sports performance and gynecological issues. In early studies, many of the variation could be accounted for by varying nutritional status of the athletes: substrate utilisation is clearly influenced. Psychological changes have reportedly had a more consistent variation in the premenstrual and menstrual period. For example, major psychological problems reported pre-menstrually and during menstruation were irritability (40% of the subjects), mood swings (38% of the subjects), fatigue (30% of the subjects) and depression (28% of the subjects) in an Australian Olympic team. Another study found no significant differences in performance times during a sixty-minute bicycle test at 65% VO2max, but an increase in RPE was reported during menstruation. POMS scores and running economy were found to be significantly different between phases of the menstrual cycle. Conversely, symptoms of dysmenorrhoea premenstrual syndrome may be relieved by exercise, possibly due to changes in central neurotransmitter or modulation of prostaglandin synthesis. However, in general the literature to support this has not described elite athletes, rather, the sedentary versus the physically active woman.

A systematic literature review was conducted to identify practical psychological interventions that improve endurance performance and to identify additional psychological factors that affect endurance performance. For the purpose of this review, endurance performance is defined as performance during whole-body, dynamic exercise that involves continuous effort and lasts for 75 s or longer. Although single or combined running, cycling and swimming events (e.g. marathons, triathlons, ultra-marathons) are most often associated with endurance, other endurance sports could include rowing, canoeing, cross-country skiing and speed skating. Visual inspection of the performance times at the London 2012 Summer Olympics suggested that more than 70 events met our definition of endurance performance. Endurance sports are also popular with recreational participants. In 2014, for example, there were more than 35,000 finishers in the London Marathon (Benhel Mosis, 1977) and more than 13,000 people participated in the London Triathlon (Carbon, 1995). Identification of psychological factors that have a causal relationship with endurance performance would support evidence-based practice. At present, however, no literature reviews have systematically identified and evaluated research on psychological determinants of endurance performance. Furthermore, in sport psychology, performance enhancement guidelines for endurance sports are not founded on a systematic appraisal of endurance-specific research.

PHYSICAL WORK OUT

Physical exercise and athletic training have become an important part of many women's lifestyles. Thirty years ago, young women and girls were discouraged from participation in such activities. Although boys were expected to participate in athletic training, girls were encouraged not to be too physically active or competitive in game and sports. Underlying this attitude was the basic belief that female reproductive function might somehow be damaged by too much exercise, especially during menstruation. The beneficial effect of physical fitness on the cardiovascular, musculoskeletal and metabolic systems is now well recognized for both men and women, and regular exercise has become an important component of healthful lifestyle. However, the increasing participating of women in athletic training programme has again brought attention to the effect of exercise on reproductive function. Vander Zwaag (1988) stated, "Sport is a competitive physical activity, utilizing specialized equipments and facilities, with unique dimension of time and space, in which quest for records are of high significance". Physical fitness is being accepted as one of the vital objectives of physical education. The adaptive capacity of the Individual to the rigors of work is determined by his physical fitness. by nature human being are competitive and ambitious for the excellence in all athletes' performance. Not only every man but also every nation wants to show their supremacy by challenging the other man or nation. This challenge stimulates, inspires, and motivates the entire nation to sweat and strives to run faster, jump higher, throw faster and exhibit greater speed, strength, endurance and skills in the present competitive sports world.

Sport psychology research on endurance performance can be divided into muscular endurance and cardiorespiratory endurance. Muscular endurance tasks (e.g. sit-ups, weight holding, hand-grip tasks and leg-raise tasks) mostly involve a single muscle or muscle group. In contrast, cardiorespiratory or aerobic endurance refers to "the entire body's ability to sustain prolonged, dynamic exercise using large muscle groups" (p. 223). This review focuses on aerobic endurance because it represents those whole-body endurance tasks that people perform recreationally and competitively. Physiologically, aerobic endurance relies primarily on energy that is derived from aerobic—as opposed to anaerobic—metabolism. The aerobic energy system produces large amounts of energy through combustion of carbohydrates and fats, but it produces energy at a slower rate than the anaerobic energy system. The relative contribution of the aerobic energy system increases with the duration of maximum-effort exercise, and Gastin estimated that the relative contribution of the aerobic energy system generally predominates after 75 s of maximum-effort exercise. As an eligibility criterion, endurance performance was therefore defined as performance during whole-body, dynamic exercise that involves continuous effort and lasts for 75 s or longer.

This review focuses on the psychological determinants of endurance performance. Whereas a correlate demonstrates a reproducible association or predictive relationship with a dependent variable, a determinant demonstrates a cause-and-effect relationship. Correlates of endurance performance include a positive effect, self-efficacy, use of psychological strategies, personal-standards perfectionism, performance approach goals and self-set personal goals. This systematic review aimed to support evidence-based practice by identifying practical psychological interventions and other psychological factors that have been shown to have a causal relationship with endurance performance in experimental or quasi-experimental research (i.e. psychological determinants).

Practical psychological interventions were defined as psychological manipulations judged to be ethical, feasible and accessible to a sport practitioner, coach or athlete. Although meta-analyses support use of goal setting, imagery, self-talk and psychological skills training (PST) packages to improve performance in a range of sport and exercise tasks, the effects of PST on endurance performance have not been reviewed.

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In contrast, associative and dissociative cognitive strategies have received much interest in the endurance literature (for reviews on this subject. Much research on association and dissociation, however, is correlational or observational; this review is interested in the experimental studies that have examined whether these cognitive strategies affect endurance performance. Although music, placebos, feedback and deception can be used to improve endurance performance, they were not included in the present review, because these psychological manipulations have been thoroughly and recently reviewed elsewhere.

Identification of practical psychological interventions that improve endurance performance, as well as additional psychological factors that affect endurance performance, could benefit the performance of competitive endurance athletes. Further, identifying methods for improving endurance performance could encourage recreational participants' continued involvement in sport by increasing their self-efficacy or perceived competence. Although experimental and quasi-experimental studies have been examining the effects of psychological factors on endurance performance for nearly 50 years, the psychological determinants of endurance performance have not been reviewed systematically. A systematic literature review was therefore conducted to identify the psychological factors that have been shown to affect (or not affect) endurance performance and to evaluate the research practices of these studies. By synthesizing research on the psychological determinants of endurance performance, this systematic review aimed to inform theoretical perspectives of endurance performance, support evidence-based practice and guide future research.

MENSTRUATION

Menstruation, which begins at puberty and ends at menopause, is a series of events occurring in a cycle, the purpose of the menstrual cycle is to prepare the uterus for nurturing a new life and the destruction of that preparation if the ovum is not fertilized. The walls of the uterus become engorged with blood and nutritive elements to supply the fertilized ovum with a means of growth. This cannot return to the blood stream and so it is lost by direct flow from the uterus. A rise in weight occurs at ovulation in some women, and in others during the pre-menstruation, and may be reflected in lowered performance. The effect of the menstrual cycle on performance is highly individual and is as variable as menstrual itself. Women have won gold medals in all phases and there are no medical contra-indications to participating in sports including scuba diving provided the athlete is comfortable. Menstruation will decrease performance only in 30 percent of women. This is due to the abdominal pain. The best performance is surely during menstruation, the immediate post menstruation period, and the poorest performance is during the pre-menstrual period. This is due to the fact that women tend to perform better when they are relaxed and at ease. On the onset of menstruation, the tension is relieved and so they perform well. During premenstrual period they are depressed, irritated and tense. Hence it affects their performance

PERIODIZED TRAINING FOR THE POTENCY ATHLETE

The exploit of periodized guidance has been reported to go back as far as the antique Olympic games. Its basic groundwork is that through manipulating training volume and excitement, in coincidence with appropriately timed short receipt phases, the athlete can reach peak condition at the appropriate time, and decrease the risk for overtraining. This article will address the background of periodization, its efficacy and various models of periodized training, with the primary emphasis on the strength/power athlete.

The basic belief of periodization is a shift from an importance of high volume (exercises x sets x repetitions) and low intensity (% of maximum effort) training to low volume and high intensity training. The training year is divided into divergent phases known as mesocycles. Each mesocycle relates to modify in the volume and intensity of training, and may last for 2 – 3 months depending upon the athlete. Typically each mesocycle reflects a specific training emphasis for that phase of training. The initial mesocycle is called the preparatory or hypertrophy phase and consists of high volume and low intensity training. It is designed to primarily increase muscle mass and muscle staying power, and to prepare the athlete for more advanced training during the later stages of training. The next two mesocycles are usually referred to as the strength and strength/power phases, in that order. In these mesocycles training intensity increases while training volume is reduced. The final mesocycle of the training year is the peaking phase. During this training phase the athlete prepares for a single contest by further reducing training volume and increasing intensity.

EFFICIENCY OF PERIODIZATION TRAINING

Increases in potency have been shown in both periodized and non periodized confrontation training programs. However, potency improvements do appear to be greater as a result of periodized training. The upper range for potency improvement in the 1RM bench press is reported to be about 17% in nonperiodized training programs and 29% in periodized training programs, while the upper range for 1RM squat is 32% in nonperiodized and 48% in periodized training. In addition, periodized resistance training programs appear to be superior than nonperiodized training programs in generating improvements in vertical jump performance. These studies provide evidence that periodized resistance training is more effective to nonperiodized training in eliciting strength and motor performance improvements. However, this advantage may be largely dependent upon the training status of the individual. The magnitude and rate of strength increases are much greater in untrained individuals than in trained individuals, therefore in consideration of the rapid strength increases seen in novice lifters, periodized training may not be necessary until a certain strength base has been established.

THE PHYSIOLOGICAL BASIS FOR TAPERING IN ENDURANCE

Taper can be defined as a structured reduction in training volume (as compared to peak training load) for a specific period of time prior to athletic competition as a means to enhance performance. In simpler terms, taper is formalized recovery training that occurs after a heavy training block. Rest as an integral aspect of training is not a recent concept. The importance of obligatory recovery time during training was recognized as early as the ancient Olympic games. However, the role of adequate rest in optimizing performance has been more widely publicized in the last 60 years with the concept of periodization, or varied training (*i.e.*, mode, time, intensity) for a specific goal.

Endurance athletes have systematically practiced relative rest via reduced-volume training as a means to improve performance for at least 50 years. However, Costill and colleagues in 1985 were the first to experimentally evaluate the physiological effects of a specific tapering protocol using competitive swimmers. Since that time, taper's efficacy has been well documented in swimming, cycling, running, triathlon, rowing, strength training, and team sports to name a few. The effects of tapering are apparent from the whole body (macro) to the cell and gene (micro) levels and even include psychological improvements . Despite the multitude of data supporting taper's effectiveness, some athletes and coaches still fail to acknowledge its importance and implement the practice. The purpose of this article is to highlight how taper is experimentally shown to enhance athletic performance across multiple exercise modes and populations. An overview of tapering in endurance-type athletes will be provided, but special attention will be paid to strength- and power-oriented athletes for whom tapering is generally less emphasized. Additionally, the discussion will highlight taper-mediated skeletal muscle improvements and provide broad literature-based guidance for tapering. We hope to underscore the necessity for coaches and athletes to employ well-controlled taper regimens during their training programs.

An effective taper regimen can be conducted in numerous ways. The duration and type of taper generally varies by sport but the common theme among endurance tapering protocols is a substantial reduction in training volume prior to competition. The literature suggests that an effective taper could be as short as four days and involve reductions in training volume of up to 90%. An improperly conducted taper where endurance exercise volume is only reduced by 25% and high- intensity work is increased to compensate will not yield favorable results. Increasing training volume instead of tapering affords no benefits and may hinder performance. For most endurance-oriented activities, a taper lasting two to three weeks characterized by a 40%–70% reduction in volume from peak training with maintained intensity will produce significant performance benefits. For a more in-depth review of specific endurance tapering protocols, refer to Mujika *et al.* , Bosquet *et al.* , and Wilson *et al.* .

The nature of taper is less defined in the literature regarding intermittent type athletic disciplines such as strength-focused weightlifting, power-focused Olympic-style weightlifting, and track and field or team sports where both strength and power are emphasized. However, a recent review on tapering in strength sports suggests (similar to endurance athletics) that performance is improved with a 30%–70% reduction in volume (via reduced intra-session volume or less overall training frequency) for up to four weeks with maintained or slightly increased intensity. The tapering literature specific to power athletes is particularly limited. However, a recent investigation found a 25%–40% reduction in resistance training volume (sessions per week) with maintained intensity improved throwing performance after two weeks in track and field athletes. Another study found enhanced maximal power output with a three week taper characterized by a ~75% resistance-training volume reduction, a slight increase in intensity, and maintained sport-specific training in elite rugby players . Similar to endurance athletes, reduced volume with maintained or slightly increased intensity appears to be the key elements for tapering in strength- and power-focused athletes.

Numerous studies spanning various exercise modes and subject populations have since corroborated the original findings of increased muscle power with taper in endurance athletes (Figure 3). Taper-derived muscle power gains may occur in two phases (early and late) which reinforces that a taper should be of adequate length (generally ≥2 weeks) . One might predict the main effect of tapering in endurance athlete's muscle would be targeted to the highly aerobic slow-twitch muscle fibers.

However, it is the less abundant and 5–8 times more powerful fast-twitch fibers that drastically respond. These fibers grow at an alarmingly fast rate with taper, improving power output without a measurable change in body mass. Improved fast-twitch fiber function may allow for a harder "push" to the finish line or improve economy (faster speed with the same amount of effort).

It has recently been shown that favorable regulation of molecular hypertrophy markers, specifically in fast-twitch fibers, may support the high rate of growth in these fibers with tapering. Although taper has a positive effect down to the molecular level, taper-mediated growth is only realized when volume is adequately reduced? To our knowledge, data on the mechanisms of performance enhancement with tapering in strength or power athletes are not available at the muscle cell level. However, strength and power training can selectively hypertrophy fast-twitch muscle fibers, potentially maximizing growth adaptation before tapering ensues. Thus, tapering likely augments performance in intermittent-type athletes by a different mechanism than in endurance athletes.

CONCLUSION

The menstruation/premenstruation phase of the menstrual cycle can affect levels of Tension-anxiety, Depression, Fatigue, Vigor and Total Mood Disturbance, that would be potentially detrimental to endurance performance. The menstrual cycle phase should be included when physiological data are being obtained for female athletes. The physiological variables of Time/speed, and abdominal /back pain etc. were also affected in a manner that could negatively influence performance.

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