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“The Effects of Magnesium Supplementation for Adolescent Female Athletes with PMS or Dysmenorrhea: An Intervention

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“The Effects of Magnesium Supplementation for Adolescent Female Athletes with PMS or Dysmenorrhea: An Intervention”

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Abstract:

A multitude of women experience the monthly challenge of premenstrual syndrome (PMS) and dysmenorrhea characterized by symptoms such as irritability, depression, anxiety, mood swings, lower abdominal pain, fatigue, and bloating. Commonly treated by the overuse of over-the-counter pain medications which often do not fully alleviate the physical signs and fail to address affective symptoms. Consequently, a notable portion of female athlete's report being unable to participate in athletic events of any kind during the menstrual phase. Moreover, the chronic use of medications like acetaminophen poses potential risks such as nausea, vomiting, and liver damage. Thus, the proposed study seeks to explore the potential success of magnesium supplementation in alleviating symptoms and enhancing participation in athletic events among female adolescents. To pursue this, a longitudinal study consisting of 300 adolescent athletes ranging in age from 15-18 will be conducted. A baseline questionnaire will be completed by each participant prior to treatment and will explore the effects of PMS symptoms and dysmenorrhea on their athletic participation. Subsequently, participants will be separated into four groups, the first given no magnesium supplementation, the second a small dose, the third a moderate dose, and the final a large dose over a six-month period. Following trial completion, the questionnaire was repeated, and a comparative analysis was conducted on their initial response. The anticipated results should demonstrate a reduction in the severity of symptoms and an increase in the ability of these athletes to participate in both practices and competitive events.

Introduction:

Adolescent female athletes encounter numerous challenges while striving for peak performance in their sport. Premenstrual syndrome (PMS) and dysmenorrhea cause various issues, such as physical and emotional symptoms occurring in the weeks leading up to menstruation, with a prevalence rate of 10%-53% (Buddhabunyakan et al., 2017). Dysmenorrhea, displayed as painful menstrual cramps, is similarly common among adolescents, affecting their daily lives and overall well-being (Donayeva et al., 2023). Despite the growing recognition of PMS and dysmenorrhea issues, limited attention has been directed towards exploring effective strategies for symptom management and alleviation. This study aims to address the gap in research by providing valuable insight into the potential benefits of magnesium supplementation for female athletes in this age range.

The primary aim of this study was to investigate how magnesium supplementation impacts symptoms of PMS and dysmenorrhea in female athletes through a longitudinal intervention study. Understanding the effects of magnesium supplementation on PMS and dysmenorrhea symptoms can lead to improved management strategies for female athletes, thereby enhancing their overall well-being and athletic performance. The findings from the research can provide empirical evidence on the effectiveness of magnesium supplementation, enabling practitioners to develop personalized management plans for female athletes experiencing menstrual-related symptoms. Longitudinal magnesium supplementation in female athletes is hypothesized to lead to a significant decrease in the severity and duration of premenstrual syndrome and dysmenorrhea symptoms compared to baseline measurements.

Literature Review:

Premenstrual syndrome (PMS) is a recurring condition which is characterized by somatic and affective symptoms throughout the luteal and menstrual phases. PMS impacts daily life and social engagement and occurs in 10%-53% of menstruating women (Buddhabunyakan et al., 2017). In a study conducted by Buddhabunyakan in 2017 on 289 highschool students in Thailand, it was concluded that 29.8% suffered from PMS symptoms This data was captured through an anonymous questionnaire regarding demographics, symptom evaluation and prevalence, and related physical limitations. This information was recorded as descriptive statistics on a daily calendar for 90 days. The SD, mean, and statistical variation were analyzed. This study was limited through self-ranking of symptoms, the absence of a clinical diagnosis, and declaration of further research or possible solutions. Additionally, no further direction for treatment or symptom alleviation was provided. Overall, the conclusion was drawn stating a notable prevalence of PMS in high school students as well as the negative implications of these symptoms on work performance and academic scores.

Dysmenorrhea, characterized by painful menstruation cramps, often coincides with premenstrual syndrome (PMS) and predominantly impacts adolescents, leading to school and activity absences. A cross-sectional comparative study was conducted on the impacts of dysmenorrhea on physical, social, and education activities of 180 adolescents ages 12-18 (Donayeva et al., 2023). Participation in the study by Donayeva (2023) was derived through convenience sampling from 43 schools in Kazakhstan in 2021-2022, however each participant was required to have a medical diagnosis of dysmenorrhea of one plus years and no other covariates. Each participant was surveyed regarding the impact of dysmenorrhea on activities using the visual analog scale. The information was analyzed using statistical analysis to categorize participants into groups of none, mild, moderate, and severe. Overall, analysis

concluded a positive correlation between the severity of dysmenorrhea and impairment of physical, social, and educational activities (Donayeva et al., 2023). This study was limited by providing no possible implications for treatment, and limited information on the consent and recruitment process. (Donayeva et al., 2023).

Magnesium deficiency can imitate numerous conditions, leading to weakness, dysmenorrhea, fatigue, and irritability (Yaralizadeh et al., 2021). Magnesium has possible positive effects on menstrual pain by decreasing levels of prostaglandins and causing muscles to relax (Fathizadeh et al., 2010). It also has a relationship with gonadal steroid concentration and is associated with a woman's reproductive age. Selective serotonin reuptake inhibitors (SSRIs) have been used to alleviate PMS symptoms but are associated with significant side effects (Dilbaz & Aksan, 2021). Many women avoid opting for SSRIs because of concerns about enduring side effects, a preference for holistic and natural approaches, apprehensions about dependency, and alignment with personal beliefs and values. Given these considerations, magnesium supplementation emerges as a promising alternative to SSRIs, offering a natural and potentially effective approach for managing conditions like dysmenorrhea and PMS.

Studies have proven the benefits of magnesium on PMS symptoms and improving the individual's quality of life. A significant correlation was noted in the alleviation of dysmenorrhea symptoms among women with regular menstrual cycles, excluding those with a history of chronic disease, oral contraceptive use, or vitamin supplementation (Yaralizadeh et al.,2021). Both 150mg and 300mg of magnesium showed improvement, with better results observed with the 300mg dosage than the 150mg dosage, according to Yaralizadeh et al. (2021). Nonetheless, a different study investigates the potential synergies and outcomes of combining magnesium with vitamin B6, revealing that the combination had a more pronounced effect in alleviating PMS

symptoms than the singular use of magnesium. (Fathizadeh et al., 2010). A shared concern in the two studies was the relatively small sample sizes, with participant numbers of 60 in Yaralizadeh et al. (2021) and 64 in Jaripur et al. (2022), respectively. Another concern was the duration of the intervention, given that the studies revolve around the menstrual cycle. Most likely, the longer duration studies are more reliable data since more cycles would be involved with the cycle group.

A 2023 study of an *in vitro* model combines magnesium with other micronutrients such as tryptophan, resveratrol, and saffron. The study utilized a human cell line of uterine smooth muscle (Battaglia et al., 2023). The combined supplement acts as an antioxidant that inhibits the increase of *PGF2α*. The inhibition of PGF*2α*, results in the levels (Ca2+) to diminish coincidently. The management of the hormone *PGF2a* impedes (Ca2+) from increasing. This also impedes the cycle from continuing and provides an effective way to manage PMS and dysmenorrhea (Battaglia et al., 2023).

Currently published studies focus on nutrition supplements for prevention and management of symptoms that include lower abdominal cramping that may extend to the extremities, nausea, diarrhea, and constipation. In a research study conducted in 2020, dysmenorrhea presented when increased levels of vasopressin and prostaglandin F2a (PGF2α) were found in women diagnosed with dysmenorrhea (Ferries-Rowe et al., 2020). As these hormones increase, intracellular calcium (Ca2+) accumulates as well. On the other hand, the levels of progesterone decrease during the luteal stage of the menstrual cycle. These concurrent events cause vasoconstriction in the smooth muscle of the uterus and cause pain (Ferries-Rowe et al., 2020).

Conclusively, premenstrual syndrome and dysmenorrhea largely impact and affect adolescents in their social, academic, and physical activities. Specifically, the impact on physical activities throughout the menstrual phase has been extensively studied however, little research has been done in methods of alleviating symptoms. Magnesium deficiency, however, has been shown to be associated with increased symptoms of PMS and dysmenorrhea. We will investigate the potential influence of magnesium on alleviating PMS symptoms, particularly somatic indications. Lastly, we aim to address the existing research gap pertaining to athletes and complications arising from PMS. If magnesium supplementation is provided, PMS and dysmenorrhea symptoms will be alleviated thus decreasing the prevalence of missed practices and games in adolescent athletes.

Methods:

This study will be conducted on three hundred adolescent girls ranging from fifteen-eighteen years old. To recruit participants, flyers and information pamphlets will be distributed to highschool sports team coaches nationwide and advertised in doctors' offices. Inclusion criteria mandates a medical diagnosis of either PMS or dysmenorrhea sustained for at least one year, with active symptom experience. Along with this, subjects must be presently engaged in a sport or athletic event consistently for a minimum of six months. For participants under eighteen, written parental consent will be required, while those eighteen will provide informed written consent. Each participant and their representative will receive detailed information regarding the study's purpose, background, design, and the conditions of PMS and dysmenorrhea. This will include preliminary research supporting the investigation of magnesium

supplementation for symptom alleviation and the negative effects of these conditions on athletes. No compensation was provided to participants to prevent bias in results.

The primary objective of the study is to explore the effects of magnesium supplementation on PMS and dysmenorrhea symptoms in female athletes through a longitudinal intervention study. The independent variable will be the dosage of magnesium supplements, while the dependent variable will be the effect of supplementation on subjects' symptoms of PMS and dysmenorrhea and its correlation with attendance to athletic events. Symptom assessment, including missed practices, games, and use of over-the-counter painkillers will be conducted monthly via questionnaire.

Participants will be randomly assigned into control and experimental groups using computer-generated randomization. Each subject will complete a pre-test questionnaire to rate their symptoms intensity and its impact on their athletic participation. The questionnaire will be sent and completed electronically. The experimental group will be further divided into three subgroups receiving varying doses of magnesium supplementation: 100 mg, 200 mg, and 300 mg, within the tolerable upper limit of 350 mg daily. The control group will be provided a placebo supplementation and none of the participants will be aware of their group affiliation or dose amount. Participants will complete monthly questionnaires throughout the six-month intervention period to assess changes in symptoms and athletic attendance.

Data analysis will involve comparing pre-test and post-test scores of each individual's responses and between groups using a paired t-test, with a significance level set at $p=0.05$. An ANOVA statistical test will be completed to determine statistical significance between the results obtained from each group. The six-month duration allows for comprehensive evaluation across multiple menstrual cycles, considering magnesium’s typical onset of action within one to four

weeks (Woods, 2023). Ethical oversight, including patient health, informed consent, potential harm, and privacy, will be ensured through IRB approval and monitoring by an impartial ethics committee prior to publication.

Possible Results and Implications for Practice:

The age range of study participants ranged from 15 to 18 years old for this randomized control trial. Study participants were all engaged in a sport or athletic event consistently for a minimum of six months. Prior to this study, a medical diagnosis of either PMS or dysmenorrhea sustained for at least one year. Symptoms experienced prior to this study were recorded in the pretrial questionnaire. Patients' symptom intensities ranged from Mild, Moderate, and Severe.

Magnesium supplementation was provided to the adolescent athletes to observe how it will impact their participation and symptoms during the menstrual phase. Magnesium Supplementation doses varied from 100 mg, 200 mg, and 300 mg. A control group will be provided a placebo supplementation. To assess changes in symptoms and athlete attendance, monthly questionnaires were administered throughout the six-month intervention period.

Magnesium supplementation is hypothesized to prove effective in decreasing symptoms of PMS and dysmenorrhea during the menstrual phase. The 300mg dosage could provide the most effective reduction of dysmenorrhea and PMS symptoms.

A future study could focus on a slightly older female athlete population ranging from 18 to 25 years old.

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