

## **Aktivitas Fisik Teratur, Asupan Makanan Tinggi Kedelai, dan Sindrom Premenstruasi pada Wanita Dewasa Muda: Penelitian Deskriptif**

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### **Abstrak**

Sindrom premenstruasi (PMS) pada kelompok remaja adalah salah satu gangguan yang paling umum pada wanita pada usia reproduksi. Secara substansial mengurangi kualitas hidup bagi banyak wanita usia reproduksi, pengobatan menggunakan obat-obatan memiliki kemanjuran terbatas dan menimbulkan efek samping tertentu. Gaya hidup sehat, misalnya aktivitas fisik teratur dan asupan makanan tinggi kedelai telah direkomendasikan sebagai metode untuk mengurangi gejala PMS. Penelitian ini bertujuan untuk mendeskripsikan aktivitas fisik dan asupan kedelai serta gejala PMS pada siswa perempuan Sekolah Menengah Kejuruan Negeri (SMKN) 10 Surabaya. Penelitian ini dirancang untuk menggambarkan tingkat aktivitas melalui metode recall 7x24 jam, asupan kedelai, dan gejala PMS pada siswa perempuan melalui wawancara menggunakan kuesioner terstruktur. Hasil penelitian menunjukkan bahwa responden (n = 59) memiliki tingkat aktivitas fisik ringan (88,1%), tingkat asupan kedelai sedang (17,22-28,38 porsi per bulan), dan gejala PMS ringan (71,2%) . Berdasarkan hasil tabulasi silang menunjukkan bahwa responden yang memiliki aktivitas fisik ringan mengalami tingkat PMS sedang (8,6%), dan yang memiliki asupan makanan tinggi kedelai mengalami tingkat PMS sedang (8,5%). Berdasarkan hasil penelitian tersebut perlu dilakukan penelitian lanjutan dengan melihat hubungan antara aktivitas fisik, asupan makanan kedelai, dan gejala sindrom pramenstruasi agar hasilnya lebih jelas kemaknaannya.

**Kata Kunci:** *remaja, aktivitas fisik, sindrom pramenstruasi, asupan makanan tinggi kedelai*

### ***Regular Physical Activity, High Soy Dietary Intake and Premenstrual Syndrome (PMS) Symptoms in Young Adult Women: A Descriptive Study***

#### **Abstract**

*Premenstrual syndrome (PMS) in adolescents group is one of the most common disorder in woman at reproductive age. It substantially reduces quality of life for many women of reproductive age, with pharmaceutical treatments having limited efficacy and substantial side effects. A health lifestyle e.g. regular physical activity and high soy dietary intakes has been recommended as a method of reducing PMS symptoms. This study aims to describe the physical activity and high soy dietary intake and PMS symptoms in female students of Vocational High School 10 Surabaya. This study was designed to describe the activity level were*

*recalled in 7x24 hour, soy dietary intake, and severity of PMS symptoms in female students that was administrated by structured questionnaires. The result showed that of all participants (n=59) were defined as having light physical activity level (88.1%), moderate level of soy dietary intake (17.22-28.38 portions per month), and mild degree of PMS symptoms (71.2%). Based on crosstabulation showed that respondents who had light physical activity experienced moderate PMS degree (8.6%), and who had high soy dietary intake experienced moderate PMS degree (8.5%). This recommendation is based on relatively little evidence, and the relationship between physical activity, soy dietary intake, and premenstrual syndrome symptoms remains unclear.*

**Keywords:** *adolescents, physical activity, premenstrual syndrome, soy dietary intake*

## **INTRODUCTION**

Premenstrual syndrome (PMS) consists of a group of psychological and somatic symptoms that are related to the menstrual cycle (Cheng *et al*, 2013). PMS symptoms occur between 1 to 2 weeks before the period (menstruation or monthly bleeding) starts, and they usually go away after bleeding. Premenstrual syndrome can affect menstruating women of any age and experience it with different symptoms for each woman. For some women, PMS is just a monthly bother. For others, it may be severe and even topass the day (U.S. Department of Health and Human Services, Office on Women's Health, 2010).

About 75 to 90% of women at reproductive age experiences of PMS before their menstrual period (Yekta *et al*, 2015). Epidemiological surveys have estimated that the frequency of PMS related symptoms is relatively high (80-90%) (Cheng *et al*, 2013; Angst *et al*, 2001; Takeda *et al*, 2006). About 5% of women

the symptoms are so severe that they interfere with personal and social relationships or work. PMS symptoms were estimated that more than 80% of women report having at least one or more before menopause and the percentage of those who have definite syndrome is 20-40% (Pazoki *et al*, 2015; Tempel, 2001).

PMS which is defined by physical and behavioural symptoms is one of the most common disorders among women especially the younger one (Pazoki *et al*, 2015; Kim *et al*, 2004; Wittchen *et al*, 2002). PMS symptoms can be divided into two categories of physical changes (including headaches, muscle aches, fatigue, weightgain, and breast pain), and psychological symptoms and mood disorders (including depression, anger, anxiety, crying for no reason, and impaired daily functioning). There are various studies suggest that more than 150 symptoms have been associated with this syndrome (Yekta *et al*, 2015; Epperson *et al*, 2012). PMS has

adverse effects on students' academic performance and limits the academic and economic progression of this group of society (Yekta *et al*, 2015). The cause of PMS is still not fully understood. The study by Yekta *et al*, entitled several factors such as fluctuations in estrogen and progesterone levels, neuroendocrine disorders, diversity of estrogen receptors and synthesis of prostaglandins, and environmental factors such as stress, lack of mobility and exercise (Yekta *et al*, 2015). More than 300 different treatments have been suggested to relieve symptoms of PMS (Yekta *et al*, 2015; Lopez *et al*, 2012). The fluctuation of PMS is highly related to the change in the level of ovarian steroids and central neurotransmitters (Carey, 2012; Dickerson *et al*, 2003; Kim *et al*, 2006; Giannini *et al*, 1990). In a study conducted on Swedish women, the mild form of this syndrome was reported in 72% of cases (Kristjansdottir *et al*, 2013). This disorder has reported the prevalence of this disorder among high school girls as 40% (Allahvendipour *et al*, 2010). According to the study conducted women with PMS compared to women without this syndrome, had more absent days from work and more days on which they had trouble with their homework (Bloch *et al*, 2000) There are several treatments to ameliorate or eliminate the symptoms such

as nonpharmacological treatments (reduction in salt intake and animal fat consumption, physical activity and herbal medicine) and pharmacological treatments (mefenamic acid, gamma linoleic acid and fluoxetine) (Pazoki *et al*, 2015; Jarvis *et al*, 2008; Segebladh *et al*, 2009). The other study also examines that there are alternative prevention methods including diet and lifestyle changes including regular exercise, adequate sleep, and healthy balanced diet (Carey, 2012; Pinar *et al*, 2011; Siapco *et al*, 2014). A study found that soy product with high isoflavones level may alleviate PMS (Kim *et al*, 2006). Soy food is rich in isoflavone which is phytoestrogen. The phytoestrogen has similar structure to estrogen and acts as partial agonist competed with estrogen for the receptors. It binds to estrogen sites and hence reduces the effects of estrogen (Carey, 2012; Kim *et al*, 2006). Prior studies have indicated that soy food with containing high phytoestrogen may potentially alter the risk of PMS.

There is a wide range in intake of traditional soy foods and soy beverages, these are less commonly consumed by adolescents group compared to meat alternatives. From their current assessment results of soy food consumption showed that at about 20% drink soy beverages  $\geq 1x/day$  while  $\sim 23\%$  eat tofu and traditional

soy foods  $\geq 3x$ /week whereas  $\sim 54\%$  eat meat alternatives  $\geq 4x$ /week (Siapco *et al*, 2014). The dietary intake may change due to increased independence as children transition to adolescents. The study on a population of children ages 9-18 years, dietary intake patterns that assessed 5 years apart have been found to stable over time. For decades, soy foods and beverages have been readily available in Adventist school cafeterias and local groceries near communities with an Adventist presence. The families preferential consumption affect their soy dietary level (Siapco *et al*, 2014; Cutler *et al*, 2009).

The study with linear regression done by Carey in 2012 showed that soy intake was independently associated with total PMS score in the premenstrual phase and menstrual phase. After adjusting with potential confounders, every extra portion of soy intake per month would reduce the total PMS score by 0.496 degree and 0.706 degree in the premenstrual phase and menstrual phase respectively. The study showed that the increase of soy intake by 30 portions per month (intake of one more portion per day) can decrease the total PMS score by 14.88 degree and 21.18 degree in premenstrual phase and menstrual phase respectively. These results suggest that soy intake may have potential effects on lowering PMS and its severity in Hong Kong

Chinese young women (Carey, 2012).

More than 78% of student in Hong Kong were willing to try dietary therapy if soy consumption is helpful, and only 37% of those girls with PMS would take medication or doctor consultation to relieve the symptoms. The study done by Carey showed that intermediate and high soy dietary intake resulted in significant low score for pain and behavioural change in menstrual phase subscales, and similar patterns were also found in premenstrual phase (Carey, 2012).

Physical activity also plays important role to reduce the PMS symptoms. The study showed that a large proportion of students who were sedentary (91%) had PMS compared to those women (49,2%) who were physically active. The amount of aerobic exercise was significantly associated with lower water retention, autonomic reactions, and appetite (Seedhom *et al*, 2013). The physical activity may also improve the immune system function, by increasing the body's resistance to stress. Moreover, the effect of exercise on brain endorphins improves mood symptoms (Lustyk *et al*, 2004). The endorphins decrease in the brain and adrenal cortisol elevation can cause mood symptoms in individuals and during the treatment of PMS. The stress management methods are very necessary such as exercise (Kollipaka *et*

*al*, 2013).

Another study showed that 114 women of 18-33 years of aged experienced PMS more severe than those who exercised regularly (Lustyk *et al*, 2004). That physical activity can reduce the symptoms of PMS and negative psychological states such as anger, hatred, sadness and shame (Ventegodt *et al*, 2004). Some studies have shown that aerobic exercises such as walking and swimming, in comparison with non-aerobic exercise and strength training, have a greater impact on psychological symptoms of this syndrome, especially depression (Yekta *et al*, 2015).

Premenstrual syndrome may affect negatively student's academic performance, and limits social interaction. Therefore, this study aimed to investigate the physical activity and soy dietary intake as an approach to control of PMS among students. It hoped that the results of this study will be a positive step toward relieving PMS symptoms and providing favourable physical and healthy dietary life for students' achievements.

## **MATERIALS AND METHODS**

This study was a descriptive study. The population included female students in first, and second grades of Vocational High School (SMKN 10 Surabaya), Indonesia, in the academic years of 2016-2017. The samples were taken by using systematic

random sampling as many as 59 girl students aged 14-17 years old. This study excluded the third grades because consider factor stress. For this purpose, after gaining permission from the Head of School, then by referring to these schools and coordinating with school administrators, demographic and PMS questionnaires were distributed. Before presenting the questionnaires to the students, the objectives, requirements, procedures, a timing of research, and also how to complete the questionnaires were explained to them.

Inclusion criteria included being within the age range of 14-17 years, being single, having regular menstruation, incidence of different severity of PMS symptoms as registered, non-smoking, and lack of use of drugs and birth control pills, any special diet, any special surgery for women, a history of ovarian cysts, and non-specific mental and physical illnesses.

The variables included social-demographic, personal characteristics (age, menarche, duration of menstruation, pocket money per day, parents' income), physical activity level, soy dietary intake level, and premenstrual syndrome (PMS) degree. Modified Physical Activity Questionnaires-for Adults (PAQ-A) 7 days recall used to administrate the physical activity level consist of 9 question items.

Each range score was between 1 to 5. It was divided to 5 scales (very light if an average of 8 questions has score 1, light has average score 2, and moderate has average score 3, high level has average score 4, and very high level has average score 5) (Kowalski *et al*, 2004).

The measurement of soy dietary intake used semi quantitative-food

frequency questionnaire (SQ-FFQ). It consisted of 18 soy foods, and beverages often consumed by adolescent girls. Soy dietary intake was divided into several sizes. Before determination of the standard portion, soy foods and beverage were weighed (food weighing). Suggested serving size was indicated as a medium size (Table 1).

**Table 1.** The results are used as medium size (suggested serving size)

Size	Conversion into suggested serving size
None	-
Very small	½ x medium
Small	¾ x medium
Medium	Suggested serving size
Large	1 ¼ x medium
Very large	1 ½ x medium

Source : Carey, 2012

The measure the total dietary soy intake (portion per month) in common unit, both the frequency of food intake and the amount of each serving size are necessary. There was a formula to calculate the dietary intake level (number of portions per month):

$I = F \times Q$ , (I = Intake level, F = Frequency, and Q = amount per serving compared with suggested serving size).

The assessment of outcomes PMS score used MDQ (Menstrual Distress Questionnaire). It assessed the degree of PMS by covering 46 symptom items across the week before menses in the previous 4 months. The questionnaire was modified and translated in Indonesian language as

well for better understanding. Each symptom was scored between 0 to 4, which 0 for “no experience of symptom”, 1 for “present, mild”, 2 for “present, moderate”, 3 for “present, strong”, and 4 for “present with a severe degree”. The 46 symptoms were classified into 8 groups including pain, water retention, auto reaction, negative affect, impaired concentration, behaviour change, arousal, and control.

All data have been analyzed by using a computer application program (Nutri Survey). The results were presented in the distribution frequency table with percentage and proportion of data.

**RESULTS**

The distribution frequencies among the participants are 15-16 years old (42.4%) and 76.4% among them has normal in menarche ( $\geq 12$  years old). Length of menstruation was  $< 8$  days (69.5%) and 30.5% for longer than  $> 8$  days. Among the participants, those who have  $> 5.000$  IDR-

12.000 IDR pocket money per days were 62.7%, and only 2% of them have  $> 21.000$  IDR per days. The income's parent per month was 79.6% ( $< 1.000.000$  IDR -  $\geq 2.500.000$  IDR), and only 4% had  $> 3.600.000$  IDR income per month. Distribution frequencies table of physical activity level shown in Table 2.

**Table 2.** Distribution frequencies of physical activity level (n=59)

Physical Activity Level	Frequencies	Percentage (%)
Light	52	88.1
Moderate	7	11.9
Total	59	100.0

The number of soy foods and beverage based on SQ-FFQ showed that the participants consume tofu (69.5%), *tempe* (66.1%), *sayur asem* (64.4%), *tahutek* (57.6%). This study showed the most soy dietary intake in medium serving size, and soy milk was the most beverage consumed

by the participant (37.3%). The medium serving size was 1 block = 75 gr for tofu; 1 block = 75 gr *tempe*; 1 glass = 450 ml for soy milk.

The soy dietary intake level (portion per month) was shown in Table 3.

**Table 3.** Distribution frequency of soy dietary intake level (portion per month)

Soy Dietary Intake	Frequencies	Percentage (%)
Low ( $\leq 12.875$ portions per month)	24	40.7
Moderate (12.876 – 30 portion per month)	22	37.3
High ( $> 30.1$ portions per month)	13	22.0
Total	59	100.0

Table 3 concludes that soy dietary intake level is moderate. The average of soy foods consumption was 18.90 portion per month, and the lowest soy intake was 1 portion per month.

Based on Menstrual Distress Questionnaire Form A (MDQ-A) 4 months-recall administrated to the participant, there were 46 symptoms and 8 complex symptoms (*pain, water retention,*

*autonomic reactions, negative effect, impaired concentration, behavioral change, arousal, and control*). The result from pain symptoms showed that fatigue (25.4%), and backache (20.3%) were often experienced by participants in mild intensity. The other symptoms were low and mild intensity in water retention (including painful or tender breast). The autonomic reaction symptoms had only 1.7% in mild intensity (including dizziness and faintness symptoms).

Several negative effects of psychological symptoms were experienced by participants including irritability (20.3%) in mild intensity and restiveness (18.6%) in mild intensity. This study showed that there were 5.1% and 1.7% of participants experienced difficult concentration and poor judgement in high intensity before their menstrual period. Among the participants, the behavioural change

symptoms occurred in 4 months before their menstrual period and caused poor performance in daily school activities (25.4%). Among the participants, 22.0% of them experienced in order illness and only 11.0% experienced a premenopause symptom (control).

The distribution frequencies of premenstrual syndrome symptoms degree is shown in Table 4.

**Table 4.** Distribution frequencies of premenstrual syndrome symptoms degree

<b>Premenstrual Syndrome (PMS) Degree</b>	<b>Frequencies</b>	<b>Percentage (%)</b>
Mild	42	71.2
Moderate	10	16.9
Severe	7	11.9
Total	59	100.0

The cross-tabulation of physical activity level and premenstrual syndrome degree were shown in Table 5.

**Table 5.** The cross-tabulation of physical activity level and Premenstrual Syndrome (PMS) degree

<b>Physical Activity Level</b>	<b>Premenstrual Syndrome Degree</b>						<b>Total</b>	
	<b>Mild</b>		<b>Moderate</b>		<b>Severe</b>		<b>n</b>	<b>%</b>
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>n</b>	<b>%</b>		
Low	41	69.5	11	8.6	0	0.0	52	88.1
Moderate	3	5.1	3	5.1	1	1.7	7	11.9
Total	44	74.6	14	23.7	1	1.7	59	100.0

Based on Table 5, low level of physical activity 11.8% experienced moderate PMS degree and 69.5% mild PMS degree.

The soy dietary intake level and premenstrual syndrome (PMS) degree were shown in cross-tabulation (Table 6).

**Table 6.** The cross-tabulation of soy dietary intake level and Premenstrual Syndrome (PMS) degree

<b>Soy Dietary Intake Level</b>	<b>Premenstrual Syndrome (PMS) Degree</b>						<b>Total</b>	
	<b>Mild</b>		<b>Moderate</b>		<b>Severe</b>		<b>n</b>	<b>%</b>
	<b>N</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>		
Low	18	30.5	6	10.2	0	0.0	24	40.7
Moderate	16	27.1	5	8.5	1	1.7	22	37.3
High	10	16.9	3	5.1	0	0.0	13	22.0
Total	44	74.6	14	23.7	1	1.7	59	100.0

This result showed that soy dietary intake in low level experienced moderate PMS degree 10.2% higher than soy dietary high intake level (5.1%).



## DISCUSSION

Adolescence is the transitional phase of physical and mental development between childhood and adulthood and characterized by immense hormonal changes. The most striking change in adolescent girls is the onset of menstruation. In the Asian context, the age of onset of menstruation or menarche is generally between 11 to 15 years. In Delhi, various studies found the mean age at menarche as 13.5(2001), 13.34(2006) years respectively (Garg *et al*, 2001; Acharya *et al*, 2006). Though the timing of this process is individually specific, within a broad range of normality after menarche, common menstrual abnormalities that the female adolescent may encounter include dysmenorrhoea, irregularities in menstrual flow and premenstrual syndrome.

The menstruation cycles in adolescence are different from adult women. Menstrual cycles are often irregular through adolescence, particularly the interval from the first to the second cycle. Menstrual irregularities can be caused by disturbance of the central gonadotropin-releasing hormone pulse generator as well as by significant weight loss, strenuous exercise, and severe stressors. It was found that the length of menstrual flow more than 7 days. These

girls are at risk of iron deficiency anaemia which can be avoided by iron supplementation.

Due to environmental factors, including socioeconomic conditions (e.g. family income and students' pocket money) and nutrition, there is a lot of variation in timing and progression of puberty. So, previous cycle may not be normal in the current scenario (Patavegar *et al*, 2015). This study showed that improving age at menarche may be a proxy indicator of ongoing improvement in the socioeconomic status in the study area.

There is no single treatment universally accepted in relation to PMS. Some studies suggest that there is an inverse relationship between PMS and exercise. This study showed that the girls have a light physical activity level. A number of researchers believe that an increase in aerobic exercise for 20 to 30 minutes 3 times per week, and exercise such as stress reduction techniques can improve PMS symptoms. Normally, the body uses phosphagens to provide energy in activities lasting up to 15 seconds, glycolytic in any activity that last between 1 to 3 minutes, and oxygen (aerobic) in activities that last more than 5 minutes. Although the effects of exercise on the treatment of PMS symptoms have not been directly studied,

evidence suggests that it can be helpful in reducing symptoms (Rapkin and Mikacich, 2013).

Dietary modification and physical activity are traditionally the first lines of therapy for premenstrual syndrome. Isoflavonic phytoestrogens, which are present in large amounts in soy products, have a structural and functional similarity to 17  $\beta$ -estradiol and either mimic or antagonise the actions of estrogens (Pike *et al*, 1999). Isoflavones can affect estrogen metabolism. Change in hormone patterns can be complicated by a tightly linked hypothalamic-pituitary-ovarian system. Additionally, isoflavones have been suggested to alter adrenocortical function (Mesiano *et al*, 1999). As estrogen hold fluid, the high estrogen level cause water retention and cause physical symptoms of PMS (Latif *et al*, 2014). By blocking the estrogen receptors, PMS might be minimized.

Menstruation is a normal phenomenon which is an important indicator of women's health (MacPherson and Korfine, 2014). However, data on experiences of menstruation and its impact on the health status, quality life, and social integration among women in developing countries are scant (El-Gilany *et al*, 2005). Premenstrual syndrome (PMS) is one of the most common disorders in women at

reproductive age that could significantly interfere with activities of daily life. PMS is not real life threatening but it can seriously alter the quality of life, school and work performances and mental health (O'Brien, 1985).

As we know PMS symptoms can decrease the quality of life including social interaction, mental health, low work and school performance. Researchers reported that there is a great difference in the pattern of symptoms between Western and Asia population. Carey reported that usually, Asian female suffered more from physical discomfort such as premenstrual fatigue and pain( Latif *et al*, 2014). Mood and behaviour change are experienced by western female. The dietary patterns could provide potential explanations to the variations of the epidemiology of PMS.

The study showed that the most usual symptoms include physical symptoms (fatigue, and back pain), water retention (painful and tender breast), autonomic reaction (dizziness) and psychological symptoms (irritability and poor judgment). The exact pathophysiological mechanisms of PMS are not fully understood yet. The cause of PMS is highly related to the change in the level of ovarian steroids and central neurotransmitters. High estrogen level cause water retention and cause physical symptoms of PMS, otherwise high estrogen

level cause would affect the central neurotransmitters which cause depression and mood swing (Diabetes Prevention Program Research Group, 2002); (Murray *et al*, 2002); (Royal Adelaide Hospital, University of Adelaide, Department of Clinical Nursing, 2001). Physical activity and alternative soy intake might be methods to reduce the number of circulating estrogen and reducing the sensitivity of estrogen receptors.

Physical activity may reduce the symptoms of PMS by biological mechanisms including increased levels of endorphins, impact on the level of the hypothalamic-pituitary-gonadal (HPG) axis hormones in the blood circulation, decreased levels of estrogen and progesterone, increased oxygen supply to the muscles, and improved mental and emotional state. This study showed that low level of physical activity experienced moderate PMS degree. The varying studies reported that most of women feel better while relaxed and lay down during menstruation cramp pains and during early days of the menstrual cycle, while some women feel less pain with physical activity (Society, 2006). Perhaps the difference between these people can justify the reports. It seems that there are difference perspectives in negative views toward menstruation and restrictions on women's response to the menstrual cycle in

various setting of communities. Other causes of this discrepancy could be the age of the subjects and their lifestyles. For ages below 17 years, ovulation is still not completely stabilized, and thus, the possibility of this syndrome can be different.

The higher intake of soy food intake could lower the premenstrual syndrome especially the symptoms in pain and behavioural change. This study showed that low soy dietary intake level experienced moderate PMS degree higher than soy dietary in the high intake. The other study findings are consistent with the previous cross-sectional study done by Kim *et al* in the USA in 84 Korean women, which reported that high intake of soy isoflavones was associated with mild but significant reduction in PMS (Foley and Gelband, 2001). Bryant also reported that group with soy isoflavone intake had significant benefits on the reduction of PMS (Rusady, 2000).

There were limitations in this study regarding the number of participants who in menstrual time. Moreover, measuring the stress and anxiety of the participants during the study was another limitation. Further study is needed to investigate the relations between soy intake and PMS in anexperimental study. The relationship between physical activity and symptoms of this syndrome requires more extensive

research.

## **CONCLUSION**

In most of the existing researches on PMS, in the first phase of the treatments, non-drug methods such as exercise and physical activity were recommended and if the signs and symptoms persisted, medications methods can be proposed. It can be concluded that the lifestyle modification with emphasizing on increasing regular physical activity, and additional soy dietary intake, might be effective approaches in reducing PMS symptoms.

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