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INFLUENCE OF NUTRITIONAL STATUS, PHYSICAL ACTIVITY AND STRESS LEVEL ON MENSTRUAL CYCLE

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ABSTRACT

Menstrual cycle research was conducted on female students of the Public Health Study Program of Prima Indonesia University because it was found that 53% of female students experienced abnormal menstrual cycles. Irregular menstrual cycles can be an indicator of reproductive health issues such as hormonal imbalances or other endocrine disorders. This study was to see the relationship between nutritional status, physical activity and stress levels with the menstrual cycle in female students of the Public Health Study Program of Prima Indonesia University. This type of research uses analytical observational using cross-sectional design. The population in this study was 204, with 135 samples obtained by random sampling technique. Data analysis was carried out using the chi-square statistical test and multivariate logistic regression binomial. Most of the subjects experienced normal nutritional status by 63%, light physical activity by 49.6%, moderate stress level by 83% and abnormal menstrual cycle (oligomenorrhea menstrual cycle > 35 days) by (60%). There was no relationship between nutritional status (p=0.650) and physical activity (p=0.528) with menstrual cycle. There was an association between stress level (p=0.043) with menstrual cycle. Thus, nutritional status and physical activity did not correlate with the menstrual cycle, but stress level correlated with menstrual cycle of students. Based on the research findings, it is recommended to implement stress control programs and increase awareness about the menstrual cycle for female students.

Keywords: nutritional status, physical activity, stress level, menstrual cycle, female college students

Introduction

One of the problems that cause discomfort in women is if there are menstrual cycle problems every month. Disruption of the irregular menstrual cycle when allowed to continue has a 2 times greater risk of developing ovarian cysts.[1] The definition of menstruation is something that occurs in women as a sign of puberty. The menstrual process that occurs in women is the process of shedding the inner layer of the female uterine wall.[2] The menstrual cycle is the time span (distance) between the start date of the current menstruation and the start date of the next menstruation.[3]

The menstrual cycle is said to be short if it is less than or equal to 25 days 25 days, the normal menstrual cycle is 26-34 days, and the long menstrual cycle when it is greater than or equal to 35 days.[4] Every woman experiences different menstrual cycles, this occurs due to various factors. Some factors that can affect the menstrual cycle are age, nutritional status, emotional state and body fat mass.[5] It is known that the menstrual cycle in adolescent girls can be influenced by other factors, namely, physical activity, macronutrient adequacy and endocrine disorders. However, there are two main variables associated with the menstrual cycle, namely nutritional status and stress.[6]

Some of the factors that cause nutritional problems include the habit of eating fast food among adolescent women. This habit is caused by family food behavior that is not in accordance with the principles of balanced nutrition since childhood and improper understanding of nutrition such as limiting food consumption to keep the body looking proportional.[7] Another variable that can affect the menstrual cycle is physical activity. The definition of physical activity quoted from the World Health Organization (WHO) in 2018 is all forms of movement performed by the body by skeletal muscles that can result in an increase in energy expenditure.[8] Doing high physical activity can cause disturbances in the menstrual cycle, the intensity of exercise and the type of exercise can also affect the severity of symptoms of menstrual cycle disorders that occur due to hypothalamic dysfunction.[9] Physical activity and menstrual function have a relationship, where the menstrual function in question is related to menstrual patterns such as bleeding duration, menstrual regularity, menstrual cycle length and the like.[10]

The third main variable is stress, a state of stress and emotional disturbance caused by changes in environmental conditions and pressures experienced by adolescent women.[11] Based on the results of research conducted on menstrual cycle disorders are related to stress. Respondents in a state of stress have a risk of 7.3 times menstrual cycle disorders compared to respondents who do not experience stress.[12] Research conducted on 80 female students of Medicine Faculty of *Universitas Sumatera Utara* (USU), around 86.3% experienced an abnormal menstrual cycle.[13] Research conducted on female students of the boarding school Surya Global Health Sciences College Yogyakarta on 67 female students, 92.5% experienced a disturbed menstrual cycle.[14]

This study investigates the relationship between nutritional status, physical activity, and stress levels with menstrual cycles among female students at Prima Indonesia University's Public Health Study Program, finding that stress significantly affects menstrual irregularities, unlike nutritional status and physical activity. Previous research shows mixed results on the impact of nutrition and physical activity on menstrual cycles, with some indicating hormonal imbalances from poor nutrition and high physical exertion affecting menstrual health. However, this study aligns with those suggesting no significant relationship between these factors and menstrual cycle regularity. Consistent with prior findings, this study reinforces the strong correlation between stress and menstrual irregularities, emphasizing the need to address psychological well-being to manage menstrual health effectively.

College students tend to experience problems with nutritional status, physical activity and stress levels, resulting in problems with the menstrual cycle. Disorders in the irregular menstrual cycle if allowed to continue have a 2 times greater risk of developing ovarian cysts.[1] An initial survey conducted on 30 female students of the Public Health Study Program of the faculty of medicine, dentistry and health sciences of Universitas Prima Indonesia (Fakultas Kedokteran, Kedokteran Gigi dan Ilmu Kesehatan Universitas Prima Indonesia or FKKGIK UNPRI) found the results of 16 people (53%) of them experiencing menstrual cycle disorders and 14 students (47%) who experienced a normal menstrual cycle. Students with a nutritional status of less than 5 people (17%), a normal nutritional status of 22 people (73%), a nutritional status of more than 3 people (10%). College students who do light physical activity are 15 people (50%), three people (10%) of them do moderate physical activity and 12 people (40%) of them do heavy physical activity. The level of stress experienced by female students was found to be 23 people (77%) experiencing moderate stress and 7 (23%) others experiencing severe stress. Based on the results of the initial survey conducted by researchers, the research aims to of this study was to see the relationship between nutritional status, physical activity and stress levels with the menstrual cycle in female students of the Prima Indonesia University Public Health Study Program.

Methods

This study was analytical observational using a cross-sectional design where observations and research are carried out at one time. The independent variables in this study are nutritional status, physical activity and stress levels. Nutritional status is a condition caused by the balance of nutrients needed by the body of female students with those needed to metabolize female students, measuring instruments used digital stepping scales and microtoise. Using Body Mass Index (BMI)

if female students at the age of more than or equal to 19 years, BMI below 18.5 means showing underweight, BMI 18.5-24.9 indicates normal weight, BMI 25-29.9 indicates overweight.[15]

Physical activity is all forms of movement performed by the body by skeletal muscles that can result in an increase in energy expenditure.[8] The measurement of physical activity is carried out using the International Physical Activity Questionnaire (IPAQ). Data from the IPAQ questionnaire is presented in minutes-MET (Metabolic Equivalent of Task) per week. Physical activity is categorized as light score < 600 METs, moderate score 600-1500 METs and heavy score > 1500 METs.[3]

Stress level is a state of what is perceived by female students from the stimulus that comes, such as pressure and support, which can affect the physical and psychological state of female students and stress measurement is done using the Perception of Academic Stress Scale (PASS) Questionnaire. Stress levels were categorized into mild stress, moderate stress and severe stress.[16] The dependent variable in this study is the menstrual cycle which is the time span (distance) between the start date of the current menstruation and the start date of the next menstruation.[3]

This research was conducted at the Public Health Program of FKKGIK UNPRI, in 2023. The population in this study was 204, the number of samples 135 obtained from the Slovin formula with a confidence level of 95% and sampling using the random sampling technique. The data collected in this study are secondary data obtained from the study program to obtain the population and sample size, while primary data are obtained from research sources conducted by written questionnaires given to respondents and measurements made using digital step scales and microtoise. Data analysis was carried out using the *chi-square* statistical test with a 95% confidence level and multivariate logistic regression binomial. And has obtained a certificate of ethical feasibility from the Health Research Ethics Commission (Komisi Etik Penelitian Kesehatan or KEPK) UNIVERSITAS PRIMA INDONESIA with number: 054/KEPK/UNPRI/XI/2023.

Results

The characteristics of female students studied in this study are age and semester level, the complete research results can be seen in Table 1, the results showed that the majority of female students were in the age category of 19 years as many as 73 people (54.1%) and the 3rd semester as many as 88 people (65.2%). The results of research on the nutritional status of female students, 85 people (63%) experienced normal nutritional status followed by nutritional status less and more as many as 25 people (18.5%) each. In terms of physical activity level, 67 people (49.6%) did light physical activity followed by heavy physical activity as many as 42 people (31.1%), and moderate physical activity as many as 26 people (19.3%). In terms of stress level, 112 people (83%) experienced moderate stress followed by severe stress as many as 15 people (11.1%) and mild

stress as many as 8 people (5.9%). There were 81 students (60.0%) who experienced abnormal menstrual cycles and 54 students (40.0%) who experienced normal menstrual cycles.

Table 1. Frequency Distribution of Female Student Characteristics

Characteristics	Frequency (N = 135)	%
Age		
19 years old	73	54.1
20 - 22 years	60	44.4
23 years old	2	1.5
Semester Level		
3rd semester	88	65.2
5th semester	26	19.3
7th semester	21	15.6
Nutrition Status		
Underweight	25	18.5
Normal	85	63.0
Overweight	25	18.5
Physical Activity Level		
Light	67	49.6
Medium	26	19.3
Heavy	42	31.1
Stress Level		
Light	8	5.9
Medium	112	83.0
Heavy	15	11.1
Menstrual Cycle		
Not Normal	81	60.0
Normal	54	40.0

In the Table 2, it is found that 25 female students with a under nutritional status, as many as 17 people (68%) experienced abnormal menstrual cycle followed by a normal menstrual cycle of 8 people (32%). Students with overweight status as many as 25 people, 15 people (60%) experienced an abnormal menstrual cycle followed by a normal menstrual cycle of 10 people (40%). Through this study, it was also found that out of 85 female students with normal nutritional status, 49 people (57.6%) experienced abnormal menstrual cycles followed by 36 people (42.4%). Statistical test results using *chi square* with p-value 0.650, so can be concluded that there is no relationship between nutritional status and the menstrual cycle in undergraduate students of the Public Health Study Program of FKKGIK UNPRI.

Table 2. Relationship between Nutritional Status, Physical Activity and Stress Level with Menstrual Cycle of Public Health Study Program Students Prima Indonesia University

Nutrition Status	Menstrual Cycle						p-value	OR	95%CI	
	Not Normal		Normal		Total					
	n	%	n	%	N	%			Under	Upper
Underweight	17	68.0	8	32.0	25	100.0				
Normal	49	57.6	36	36.0	85	100.0	0.650	1.182	0.67	2.085
Overweight	15	60.0	10	40.0	25	100.0				

In the table 3, the results obtained those 67 female students with light physical activity, 39 people (58.2%) experienced an abnormal menstrual cycle followed by a normal menstrual cycle of

28 people (41.8%). The study also found that 26 female students with moderate activity, 14 people (53.8%) experienced an abnormal menstrual cycle followed by a normal menstrual cycle of 12 people (46.2%). There were 42 female students who did heavy physical activity, 28 people (66.7%) experienced an abnormal menstrual cycle followed by a normal menstrual cycle of 14 people (33.3%). Statistical test results using *chi square* with p-value 0.582, so it can be concluded that there is no relationship between physical activity and the menstrual cycle in undergraduate students of the Public Health Program of FKKGIK UNPRI.

Table 3. Relationship between Physical Activity and Menstrual Cycle in Public Health Study Program Students at Prima Indonesia University.

Physical Activity	Menstrual Cycle						p- value	OR	95%CI	
	Not Normal		Normal		Total					
	n	%	n	%	N	%			Lower	Upper
Light	39	58.2	28	41.8	67	100.0				
Medium	14	53.8	12	46.2	26	100.0	0,528	0..851	0.573	1.264
Heavy	28	66.7	14	33.3	42	100.0				

In the table 4, it was found that female students experienced mild stress as many as 8 people, 3 people (37.5%) experienced an abnormal menstrual cycle followed by a normal menstrual cycle of 5 people (62.5%). There were 112 students with moderate stress, 65 people (58%) experienced an abnormal menstrual cycle followed by a normal menstrual cycle of 47 people (42%). College students with severe stress as many as 15 people, 13 people (86.7%) experienced an abnormal menstrual cycle followed by a normal menstrual cycle of 2 people (13.3%). Statistical test results using *chi square* with p-value 0.043, so it can be concluded that there is a relationship between stress levels and the menstrual cycle in female students of the Bachelor of Public Health Program, FKKGIK UNPRI.

Table 4. Relationship between Stress Level and Menstrual Cycle in Public Health Study Program Students at Prima Indonesia University.

Stress Level	Menstrual Cycle						p-value	OR	95% CI	
	Not Normal		Normal		Total					
	n	%	n	%	N	Lower			Lower	Upper
Light	3	37.5	5	62.5	8	100.0				
Medium	65	85.0	47	42.0	112	100.0	0,043	0.3	0.110	0.818
Heavy	13	86.7	2	13.3	15	100.0				

The results of the logistic regression test show that the stress level has a p-value of 0.016, so the stress level affects the menstrual cycle. In table 5, the OR for stress level is 0.286 with a 95% CI of (0.103, 0.795), indicating a statistically significant negative association between stress level and menstrual cycle regularity, unlike nutrition status and physical activity level, whose CIs include 1, suggesting no significant association.

Table 5. Factors Associated with Menstrual Cycle with Multivariate Logistic Regression.

Independent Variable	P Value	OR	95% CI	
			Lower	Upper
Nutrition Status	0.726	1.110	0.619	1.991
Physical Activity Level	0.289	0.800	0.53	1.208
Stress Level	0.016	0.286	0.103	0.795

Discussion

Research conducted on level II female students of the Panca Bhakti Midwifery Academy in Bandar Lampung, showed that respondents with poor nutritional status correlated with irregular menstrual cycles by 2.8 times compared to respondents who had good nutritional status.[11] Overnutrition status in female students can lead to an increase in the amount of estrogens hormones in the blood due to an increase in the amount of fat in the body, this can lead to menstrual cycle disorders. Undernutrition status in female students can result in a decrease in the amount of estrogen hormone production due to a decrease in the amount of fat in the body, this can also result in menstrual cycle disorders in the body.[17] Overnutrition can cause menstrual disorders such as oligomenorrhea (infrequent menstruation) or anovulatory cycles (cycles without ovulation) due to hormonal imbalances.[18] Undernutrition can cause amenorrhea (no menstruation) or irregular menstrual cycles because insufficient energy intake interferes with the production of hormones that regulate the menstrual cycle.[19]

From this study, among the 85 people who experienced normal nutritional status, the majority of female students experienced an abnormal menstrual cycle of 49 people (57.6%). This may be due to other factors besides nutritional status, because the menstrual cycle in women is strongly influenced by other factors such as stress so that there are female students with normal nutritional status but have a tendency to have an abnormal menstrual cycle. Based on previous research, there are two main variables associated with the menstrual cycle, namely nutritional status and stress.[6] Similar to undernutrition and overnutrition, stress can also affect the work of the hypothalamus so that the hormones needed by the body, especially reproductive hormones, cannot be produced properly and eventually the menstrual cycle becomes irregular.[20]

The results of statistical analysis obtained p = 0.467 where there was no significant relationship between nutritional status and the menstrual cycle in undergraduate students of Public Health FKKGIK UNPRI. The results of the same study were also in the research that there was no relationship between nutritional status and the menstrual cycle in undergraduate students of the Nutrition Study Program of Faculty of Medicine and Health, University of Muhammadiyah Jakarta.[21] In line with research conducted that there is no relationship between the nutritional status of female students of SMAN 13 Luwu and the menstrual cycle.[22] There is no significant relationship between IMT nutritional status and the regularity of the menstrual cycle of female students of the Faculty of Medicine, Andalas University.[5] Different research results were found in

Anggoro's research that there was a very significant relationship between nutritional status and menstrual cycle in female students at the Islamic Boarding School of Surya Global Health Sciences Yogyakarta.[14] Research conducted on level III adolescent girls at high school of health science Hutama Abdi Husada Tulungagung found that there was a relationship between stress level and menstrual cycle.[23]

The results obtained from the study showed that the majority of students experienced normal nutritional status. Normal nutritional status is something that every student wants, because normal nutritional status affects body shape to remain normal as well. The results of research conducted at the UNPRI FKKGIK Public Health S1 Study Program, where there is no relationship between nutritional status and the menstrual cycle. This indicates that female students can control their nutritional status to remain normal and not affect their menstrual cycle. Whereas in other references it has been known that the menstrual cycle in adolescent girls can be influenced by other factors, namely, physical activity, macronutrient adequacy and endocrine disorders. However, there are two main variables associated with the menstrual cycle, namely nutritional status and stress.[6]

The results of statistical analysis in the table of the Relationship between physical activity and menstrual cycle found that the majority of physical activity performed was light physical activity as many as 67 people and the majority of female students experienced an abnormal menstrual cycle 39 people (58.2%). The results of the study are in line with what show that when doing light physical activities such as sitting watching television, shopping and walking are activities that do not help the metabolic process. These light activities will result in an increase in energy reserves in adipose tissue and can cause a deficit in oxidized energy reserves, deficit oxidized reserves will have an impact on the menstrual cycle. Meanwhile, heavy physical activity can stimulate the inhibition of Gonadotropin Realizing Hormone (GnRH) which can lead to a decrease in serum esterogen levels, which in turn can disrupt the menstrual cycle.[24]

The minority of female students did moderate physical activity as many as 26 people with the majority experiencing abnormal menstrual cycle disorders as many as 14 people (53.8%). The results of different studies found that doing moderate physical activity is beneficial for the health of the body and facilitates the reproductive system.[25] Strenuous Physical Activity such as sportsmen or individuals who perform high-intensity physical exercise often experience athletic amenorrhea caused by decreased body fat and hormonal changes such as decreased Gonadotropin-Releasing Hormone (GnRH).[26] Low physical inactivity can impact hormone regulation and the menstrual cycle, which is associated with an increased risk of obesity.[27]

The results of statistical analysis found $p = 0.528$ where $p > 0.05$, this shows that there was no significant relationship between physical activity and the menstrual cycle in FKKGIK UNPRI Public Health Study Program students. In line with other studies that there was no significant relationship between physical activity and the menstrual cycle in female students of Faculty of

Health Sciences Prof. Dr. Hamka Muhammadiyah University.[28] The same research results also found that there was no relationship between physical activity and the menstrual cycle in female students of the Faculty of Public Health, Gorontalo University.[29]

The results of this study were not in line that there is a significant relationship between physical activity and the menstrual cycle in female students at the Islamic Boarding School of Surya Global Health Sciences Yogyakarta.[14] There is a relationship between physical activity and the menstrual cycle in Nursing Program students at Aisyiyah University Yogyakarta.[30] In a study conducted on students of Nursing Study Program Faculty of Health Sciences, University of Aisyiyah Yogyakarta, it was stated that respondents who performed heavy physical activity had a tendency to experience menstrual cycle disorders, because heavy physical activity would increase stressors and psychology that could aggravate the menstrual cycle.[24]

Because students do light physical activity because students are faced with an era of technology that is all digital so that it reduces the level of activity carried out by students. Like the trip to campus feels lighter and does not need extra energy because there is already an online application so that it easily gets a vehicle to travel and shop without having to spend energy to do physical activity because it can shop online which can be delivered to our address. The majority of female students only do light physical activities such as walking leisurely, when they are at home they say they are lying down and have no other activities so they do activities when they are on campus. Very rarely do female students do heavy physical activity and also exercise.

There was no relationship between physical activity and menstrual cycle in undergraduate students of Public Health Study Program of FKKGIK UNPRI. The reason why there is no relationship between physical activity and menstrual cycle is because there is a tendency for the number of subjects who experience an abnormal menstrual cycle to be greater even though they do light, moderate or heavy physical activity.

The third main variable is stress, the problem of a woman's reproductive life is influenced by several factors that can lead to menstrual disorders. One of these factors is the occurrence of disturbances and changes in the menstrual cycle caused by psychological problems such as stress and emotional disturbances caused by changes in environmental conditions and pressures experienced by adolescent women.[11] Stressful conditions can lead to menstrual cycle disorders, mild stress is not a serious problem with the menstrual cycle, but severe and prolonged stress can have a negative effect. High levels of stress can affect the menstrual cycle through neuroendocrine mechanisms. Chronic stress can disrupt the function of the hypothalamus which regulates reproductive hormones.[31]

The results of statistical analysis found that $p = 0.043$ or $p < 0.05$, indicating that there was a significant relationship between stress level and menstrual cycle. Similar to the results of research that there is a relationship between stress and menstrual cycle conducted on students of the Faculty

of Public Health, Gorontalo University.[29] There is a relationship between stress level and menstrual cycle in final year students of College of Health Sciences Hang Tuah Surabaya.[32] Research conducted on undergraduate nursing students at the Faculty of Medicine, Airlangga University found a relationship between stress levels and the menstrual cycle in female students.[20]

In contrast to the results of research that there was no relationship between stress levels and the menstrual cycle in female students of the Faculty of Health Sciences, University of Muhammadiyah Prof. Dr. Hamka.[33] There is no significant relationship between stress and menstrual cycle in undergraduate midwifery students of Sari Mulia class of 2020.[34]

According to the results obtained, there was a relationship between the level of stress and the menstrual cycle in female students of the FKKGIK UNPRI Public Health Study Program, which stated that the majority of female students experience moderate stress as many as 112 people (83%) with the majority of female students experiencing an abnormal menstrual cycle as many as 65 people (85%). Based on the findings of this study the level of stress experienced by female students is stress caused by a lot of coursework, especially at the end of the semester, the demands of lectures and exams, coupled with the burden of thought caused by hearing people's comments on academic expectations so that they encourage themselves to reach these expectations which ultimately increase pressure on themselves and academic self-perception which ultimately results in themselves feeling pressured by expectations from people and themselves making the stress experienced increase.

Nutritional status, physical activity, and stress levels have a significant influence on the menstrual cycle in female college students. Unbalanced nutritional status, both excess and deficiency, can cause hormonal imbalances that lead to menstrual cycle disorders. Physical activity that is too strenuous or high intensity is also associated with menstrual irregularities. Meanwhile, psychological stress can disrupt the function of the hypothalamus which regulates reproductive hormones, thus affecting the regularity of the menstrual cycle. The combination of these three factors shows the importance of maintaining balanced nutrition, moderate physical activity, and stress management to maintain a healthy menstrual cycle in female college students.[35]

Disruptions in the menstrual cycle are often associated with fertility and pregnancy success. Irregular or painful menstrual cycles can be indicative of reproductive health issues that require medical attention. The care and maintenance of uterine health, through good management of the menstrual cycle, is an important step in ensuring optimal conditions for fetal development and the birth of a healthy baby.[36]

Regular menstruation is an important indicator of good uterine health, which directly affects the condition of the fetus during pregnancy and the baby's birth outcome. Irregular or dysfunctional menstrual cycles may indicate a disturbance in the endometrium or inner lining of the uterus, which is important for successful embryo implantation and healthy fetal development. For example,

disturbances in endometrial receptivity can lead to delays in embryo implantation and increase the risk of embryo loss.[36]

This study has several limitations that should be considered. First, the sample size was limited to students from the Public Health Study Program at Prima Indonesia University, which may not allow for generalization to a broader population. Second, the data collection method relied on self-reported surveys, which can introduce bias or inaccuracies in the reported data. Third, other factors that may affect menstrual cycles, such as underlying medical conditions or the use of contraceptives, were not accounted for in this analysis. Fourth, this study was cross-sectional, meaning it only shows associative relationships and not causative ones.

The findings of this study have several important implications. First, the significant impact of stress levels on menstrual cycles highlights the need for interventions to manage stress among students, particularly towards the end of the semester when academic pressure increases. Second, these results can inform educational institutions in designing support programs to help students cope with academic demands and expectations. Third, although nutritional status and physical activity did not show a significant relationship with menstrual cycles in this study, maintaining a healthy lifestyle remains important as these factors influence other aspects of health. Lastly, further research with longitudinal designs and larger sample sizes is necessary to better understand the causal relationships between these factors and menstrual cycles.

Conclusions

Based on the results of this study, it was also found that there was no correlation between nutritional status and physical activity with the menstrual cycle, but the level of stress correlated with the menstrual cycle in female students of the Public Health Program of FKKGIK UNPRI. We suggest to female student to control their stress through carrying out physical activity in moderate category level. After this study, female students must increase their awareness and knowledge of the menstrual cycle. Also, policies should be made so that female students do moderate physical activity and improve stress management. Then researchers hope that the results of this study will be one of the information for future researchers. Further researchers are expected to consider and develop methods and variables that are different from this study.

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Conflict of Interest

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