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Aggregation of unhealthy food markers in High Schools

Agregação de marcadores de alimentação não saudável em escolares do Ensino Médio

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ABSTRACT

Objective

To estimate the isolated and aggregated prevalence of excessive consumption of salty, sweet and soft drinks, markers of unhealthy eating, and identify association with sociodemographic and lifestyle factors among schoolchildren.

Methods

Random sample, proportional to the conglomerates (classes). A total of 1,170 high school students aged 14 to 20 years enrolled in public schools in Jequié, Bahia in 2015 were included. Sociodemographic variables (gender, age group, family income and education) and lifestyle (consumption of fruits and vegetables, alcohol and tobacco consumption, screen time and insufficient levels of physical activity) were assessed. SPSS 11.5 (95%CI) was used to perform the chi-square test and Poisson aggregation.

Results

We found a greater consumption of sweets among girls, 27.9% ($p < 0.01$) and inadequate consumption of vegetables in boys 66.3% ($p < 0.00$). The aggregation of the three unhealthy eating markers yielded an exposure of 7.88 (95%CI; 7.87-7.90) for boys and 4.91 (95%CI; 4.87-4.95) for girls. The exposure is higher for boys who watch TV ≥ 02 hours/day (PR: 1.98; 95%CI: 1.01-3.9; $p < 0.05$) and girls (PR: 3.01; 95%CI: 1.64-5.52; $p < 0.00$), besides computer/videogame use (PR: 2.47; 95%CI: 1.4-4.35; $p < 0.00$).

Conclusion

It was observed that for both genders, watching TV or using the computer/video game for more than two hours increases the chance of consumption of unhealthy food markers.

Keywords: Adolescent. Eating habits. Life style. Risk factors.

RESUMO

Objetivo

Estimar as prevalências isoladas e agregadas de consumo excessivo de salgados, doces e refrigerantes, marcadores de alimentação não saudável, e identificar associação com fatores sociodemográficos e de estilo de vida entre escolares.

Métodos

Neste estudo, a amostra foi aleatória, proporcional por conglomerado (turmas). Foram incluídos 1.170 escolares de 14 a 20 anos do ensino médio da rede pública de Jequié, Bahia, em 2015. Por meio de um questionário, foram obtidas variáveis sociodemográficas (sexo, faixa etária, renda familiar e escolaridade) e de estilo de vida (consumo de frutas e verduras, doses de álcool e tabaco, tempo de tela e níveis insuficientes de atividade física). Utilizou-se o SPSS 11.5 (IC95%) para realização do teste de qui-quadrado e agregação de Poisson.

Resultados

Identificou-se maior prevalência do consumo de doces entre meninas (27,9%; $p < 0,01$) e consumo inadequado de verduras pelos meninos (66,3%; $p < 0,00$). O padrão de agregação dos três marcadores de alimentação não saudável foi de 7,88 (IC95%: 7,87-7,90) para os meninos e de 4,91 (IC95%: 4,87-4,95) para as meninas. Houve associação entre o padrão de agregação para os meninos que ficam na frente da televisão ≥ 02 horas/dia (RP: 1,98; IC95%: 1,01-3,9; $p < 0,05$) e para as meninas (RP: 3,01; IC95%: 1,64-5,52; $p < 0,00$), além do uso de computador/videogame por elas (RP: 2,47; IC95%: 1,4-4,35; $p < 0,00$).

Conclusão

Observou-se que, para ambos os sexos, assistir TV ou utilizar computador/videogame por mais de duas horas aumenta a chance de consumo dos marcadores de alimentação não saudável.

Palavras-chave: Adolescente. Hábitos alimentares. Estilo de vida. Fatores de risco.

INTRODUCTION

It was observed that adolescents have unhealthy habits that put their health at risk, namely insufficient levels of physical activity, alcohol consumption, high screen time, inadequate consumption of fruits and vegetables and high consumption of ultra-processed foods, such as sweets (chocolate, biscuits or sweet cookies), soft drinks and savory snacks (salty and fried foods)[1].

These ultra-processed foods when consumed in excess, by high school adolescents[2] constitute Unhealthy Eating Markers (UEM). These foods have inflammatory potential and present a cardiometabolic risk[3]; they are also associated with overweight, poor sleep quality, depression, anxiety and risk to life among schoolchildren[4]. A previous review study in one of the largest surveys carried out with Brazilian schoolchildren between 2010 and 2020, found an increase in the consumption of UEM, a reduction in the consumption of fruits and vegetables and greater exposure to risky health behaviors of schoolers[5].

In relation to gender, girls with higher family income showed high consumption of UEM, according to a survey carried out with 832 high school students in the southern region of the country[6]. In Niterói, Rio de Janeiro, a study with 448 schoolchildren found that the boys are most exposed to the outcome and, furthermore, that there is an inverse association between screen time and vegetable consumption[7]. This shows that there is no clarity regarding the factors associated with UEM in schoolchildren, especially in connection with genders; furthermore, attempts at explaining this issue, have been based only on the review of outcomes[8].

To enhance the understanding of the relationship between UEM[1] and sociodemographic and lifestyle factors[3], it is essential to employ a combined approach of cluster analysis or simultaneity analysis, aiming to broaden the understanding of how and to what extent one UEM can be added to another[9,10].

Therefore, the objective of our study was to estimate the single and aggregate prevalence of three UEM (excessive consumption of salty snacks, sweets and soft drinks) and their association with sociodemographic factors (gender, marital status, age group, occupation, family income and mother's education) and lifestyle (physical activity, sedentary behavior, consumption of fruits and vegetables, alcohol and tobacco use), of public high school students.

METHODS

This was an Epidemiological, cross-sectional study as part of a monitoring process of health risk behaviors in high school students from the state education network in the city of Jequié, Bahia.

The study was carried out in the city of Jequié-BA, which is located in the Southwest region of the State of Bahia, approximately 370km from the State capital Salvador.

The study population comprised 3,040 students, selected from 98 school classes, from 12 state public schools located in the urban area; those schools offered regular secondary education in the morning and afternoon shifts in the city of Jequié-BA, in 2015. To compose the sample, we used the calculation of random cluster sampling for a finite population[11]. The confidence interval was 95%; 15% additional participants were included to cover any loss or withdrawal, resulting in a minimum final sample of 1,388 students, aged between 14 and 20 years.

It was decided to include all schools that offered high school education in the morning and afternoon shifts located in the urban area (n=12), whose principals agreed with the survey performance. Schools in rural areas and the military police school were excluded from the study, because their Physical Education program differs from the other schools. The classes were stratified based on a probability proportional to the size of the schools and 48 classes were selected by draw among the existing 98 classes, to make up the total 1388 students, considering an average of 33 students per class.

The procedure for data collection occurred in stages, namely: prior authorization from school coordinators; approval of the university's ethical protocols with humans; scheduling and prior visits to schools to present the project to the principals, invitation and delivery of the terms of consent and positive assent forms; checking the number of rooms and students per class; application of the instrument in classes selected by drawing lots. Before data collection began, a questionnaire application training was carried out with the team, as well as an application simulation among members to answer any questions.

The instrument used for data collection was the COMPAC[2] questionnaire, which showed good reproducibility rates (0.51 to 0.97) and an average duration of 28 minutes for students to complete. Previously trained surveyors applied the questionnaire in the classroom.

Regarding the description of the variables, the personal information block (sociodemographic) included: gender (male or female), age group (<16 years or ≥16 years), marital status (single or married/other), occupation (does not have a job or has a job), family income (< two minimum wages or ≥ two minimum wages) and mother's education (< eight years of study or ≥ eight years of study). To assess sedentary behavior we used the block of physical activity and sedentary behavior which included time in front of television (TV) and computer/video games during the week, dichotomized into "<2 hours/day" and "≥2 hours per day", and physical activity[12], considered insufficiently active those students who did not accumulate the recommended minimum physical activity of at least 60 minutes per day, five days a week[12].

The block of alcohol and tobacco consumption included questions on weekly consumption and current number of doses per day of alcohol and tobacco consumption, using consumption as a criterion regardless of the number of doses or cigarettes, dichotomized into "yes" and "no". The block of eating habits and weight control for food consumption on typical days of the week, with the consumption of fruits and vegetables considered inadequate consumption "<5 days/week" and adequate consumption "≥5 days/week". The consumption of UEM was set out as follows:

consumption of Salty Snacks (SS), Sweets (SW) and Soft Drinks (SD), during a typical week[2]; excess consumption was considered >5 days/week and was used as a criterion.

The IBM®SPSS® 11.5 program was used for all the analyses. The chi-square test was used to compare the proportions of the variables: UEM, sociodemographic and lifestyle variables between the genders. For this study, the outcome variable was considered to be the aggregation pattern that obtained the highest observed prevalence value by expected prevalence (OP/EP), stratified by gender. The expected prevalence of each combination of UEM was obtained by multiplying the probability occurrence of each food based on the occurrence observed in the sample[2,13].

For example, consider the expected prevalence rates in males for the three UEM: excessive consumption of salty snacks = 18.9%; sweets = 21.6%; and, soft drinks = 20.8%. The aggregation is: $0.189 \times 0.216 \times 0.208 = 0.008$ (0.8%). However, the prevalence observed in the sample for the same aggregated foods was 6.5% and, in this case, the OP/EP is 7.88. The ratio of observed to expected prevalence (OP/EP) greater than 1 means the probability of aggregation among UEM.

Poisson regression, with robust variance[14], was performed with the aim of reviewing the relationship between the outcome variable (highest aggregate value of the UEM) and the sociodemographic and lifestyle variables, stratified by gender, with a Confidence Interval (CI) of 95%, including potential confounding factors with p values <0.20 in the adjustment.

The study is in accordance with the Declaration of Helsinki n° 466/12 and was approved by the Human Research Ethics Committee of the Universidade Estadual do Sudoeste da Bahia (approval protocol n° 83.957/14). The students who participated in the study were authorized by their parents, and those aged 18 or over signed the Informed Consent Form.

RESULTS

Initially, the sample consisted of 1,388 students out of which 16.8% (n=218) were withdrawals and losses. As a result, the final sample consisted of 1,170 students, of which 57.9% (n=678) were female, as shown in Table 1.

Regarding the sociodemographic variables, 88.6% of the girls reported they did not have a job ($p < 0.00$) and had a family income ($p < 0.00$) of up to 2 minimum wages (R\$788.00 at the time). The boys' mothers had higher levels of education ($p < 0.01$). The single prevalence of the lifestyle variables were: greater consumption of sweets among females (27.9%; $p < 0.01$), while the prevalence of inadequate consumption of vegetables was higher among males (66.3%; $p < 0.00$). Girls had insufficient levels of physical activity (87.6%; $p < 0.00$), while boys had more screen time (computer/video game) – equal to or greater than 2 hours – (32%; $p < 0.00$).

Table 2 presents information on the aggregation of UEM (salty snacks, sweet and soft drinks). Eight aggregation patterns were identified and, in six of them, the prevalence was higher than expected. When aggregating the three UEM, exposure was 7.88 times higher for boys (95%CI; 7.87-7.90) and 4.91 times higher for girls (95%CI; 4.87-4.95).

In Table 3, a greater chance of exposure to UEM was observed for boys with screen time (TV) greater than two hours (1.98; 95%CI; 1.01-3.9).

In Table 4, when evaluating the same variables for females, it was found that spending ≥ 2 h watching TV (3.01; 95%CI; 1.64-5.52) and also on video games and computers (2.47; 95%CI; 1.4-4.35) increased the chance of exposure to UEM.

Table 1 – Descriptive characteristics of the sample, stratified by gender. Jequié (BA), Brazil, 2015.

Variables	Male (n=492)		Female (n=678)		X ² p
	%		%		
*UEM (>5 days/week)					
Snacks	18.9		22.8		0.11
Sweets	21.6		27.9		0.01
Soft drinks	20.8		20.2		0.81
Sociodemographic					
Age (years)					
<16	48.8		54.4		0.06
≥16	51.2		45.6		
Marital status					
Single	90		87.3		0.15
Married	10		12.7		
Occupation					
Does not have a job	71.3		88.6		0.00
Has a job	28.7		11.4		
Mother's education					
<08 years education	33.7		41.2		0.01
≥08 years education	63.3		58.8		
Monthly family income (minimum)					
<02 minimum wages	63.8		76.7		0.00
≥02 minimum wages	36.2		23.6		
Lifestyle					
Screen Time (TV)					
≥02 hours/day	30.1		34.7		0.10
<02 hours/day	69.9		65.3		
Screen time (computer/video game)					
≥02 hours/day	32		23.9		0.00
<02 hours/day	68		66.1		
Monthly family income (minimum)					
<02 minimum wages	56.1		53.9		0.46
≥02 minimum wages	43.9		46.1		
Vegetable consumption					
<05 days/week	66.3		56.9		0.00
≥05 days/week	33.7		43.1		
Consumption of alcoholic beverages					
Yes	28.2		20.6		0.00
No	71.8		79.4		
Tobacco consumption					
Yes	8.7		3.8		0.00
No	91.3		96.2		
Level of physical activity					
Insufficient (<300min./week)	73		87.6		0.00
Sufficient (≥300min./week)	27		12.4		

Note: *UEM: Unhealthy Eating Markers; in bold, p-values <0.05; X²: chi-square test.

Table 2 – Prevalence and aggregation of three Unhealthy Eating Markers stratified by gender. Jequié (BA), Brazil, 2015.

n	UEM			Male			Female		
	SS	SW	SD	O	E	O/E	O	E	O/E
				%	%	95%CI	%	%	95%CI
0	-	-	-	62.9	51.1	1.22(1.23-1.24)	54.4	44.1	1.24(1.19-1.28)
1	+	-	-	4	11.9	0.34(0.06-0.71)	6.2	13	0.48(0.13-0.82)
1	-	+	-	5.9	14	0.42(0.04-0.81)	9.8	17.1	0.57(0.25-0.90)
1	-	-	+	8.8	12.9	0.68(0.29-1.07)	8	11.6	0.69(0.34-1.04)
2	+	+	-	6.1	3.3	1.87(1.48-2.26)	7.3	5	1.45(1.10-1.80)
2	+	-	+	2.1	3	0.70(0.31-1.08)	2.2	3.4	0.64(0.31-0.97)
2	-	+	+	2.7	3.5	0.76(0.37-1.16)	3.9	4.5	0.87(0.52-1.22)
3	+	+	+	6.5	0.8	7.88(7.87-7.90)	6.5	1.3	4.91(4.87-4.95)

Note: n: number of behaviors; (+): present behavior; (-): absent behavior; UEM: Unhealthy Eating Markers; SS: savory; SW: sweet; SD: soft drinks. O: observed prevalence; E: expected prevalence; O/E: ratio between observed and expected prevalence; CI: Confidence Interval; values in bold: presence of aggregation.

Table 3 – Gross and adjusted regression analysis between sociodemographic and lifestyle variables and the aggregation of the three Unhealthy Eating Markers for males. Jequié (BA), Brazil, 2015.

Variables	Gross Prevalence Ratio		Adjusted Prevalence Ratio	
	95%CI	p	95%CI	p
Sociodemographic				
Age (years)				
<16	1.92(0.94-3.93)	0.07*	1.76(0.86-3.61)	0.12
≥16	1		1	
Marital status				
Single	0.46(0.2-1.07)	0.07*	0.51(0.23-1.11)	0.09
Married	1		1	
Occupation				
Does not have a job	0.99(0.47-2.1)	0.99	-	-
Has a job	1		-	
Mother's education				
<08 years education	0.95(0.46-1.97)	0.89	-	-
≥08 years education	1		-	
Monthly family income (minimum)				
<02 minimum wages	0.48(0.24-0.95)	0.04	0.51(0.23-1.11)	0.1
≥02 minimum wages	1		1	
Lifestyle				
Screen Time (TV)				
≥02 hours/day	1.98(0.99-3.95)	0.05*	1.98(1.01-3.9)	0.05
<02 hours/day	1		1	
Screen time (computer/video game)				
≥02 hours/day	1.34(0.67-2.7)	0.4	-	-
<02 hours/day	1		-	
Fruit consumption				
<05 days/week	1.23(0.61-2.48)	0.55	-	-
≥05 days/week	1		-	
Vegetable consumption				
<05 days/week	1.01(0.48-2.2)	0.96	-	-
≥05 days/week	1		-	
Alcohol consumption				
Yes	1.56(0.79-3.12)	0.21	-	-
No	1		-	
Tobacco consumption				
Yes	2(0.81-4.95)	0.13*	2.02(0.88-4.64)	0.1
No	1		1	
Level of physical activity				
Insufficient (<300 min./week)	0.93(0.44-1.96)	0.84	-	-
Sufficient (≥300min./week)	1		-	

Note: *p<0.20. Values in bold: p<0.05. CI: confidence interval.

Table 4 – Gross and adjusted regression analysis between sociodemographic and lifestyle variables and the aggregation of the three Unhealthy Eating Markers for females. Jequié (BA), Brazil, 2015.

Variables	Gross Prevalence Ratio		Adjusted Prevalence Ratio	
	95%CI	p	95%CI	p
Sociodemographic				
Age (years)				
<16	1.2(0.67-2.15)	0.53	-	-
≥16	1		-	
Marital status				
Single	0.93(0.4-2.12)	0.86	-	-
Married	1		-	
Occupation				
Does not have a job	1.77(0.56-5.56)	0.33	-	-
Has a job	1		-	
Mother's education				
<08 years education	0.88(0.49-1.61)	0.71	-	-
≥08 years education	1		-	

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Table 4 – Gross and adjusted regression analysis between sociodemographic and lifestyle variables and the aggregation of the three Unhealthy Eating Markers for females. Jequié (BA), Brazil, 2015.

Variables	Gross Prevalence Ratio		Adjusted Prevalence Ratio	
	95%CI	<i>p</i>	95%CI	<i>p</i>
Monthly family income (minimum)				
<02 minimum wages	1.04(0.53-206)	0.90	-	-
≥02 minimum wages	1		-	
Lifestyle				
Screen Time (TV)				
≥02 hours/day	3.28(1.81-5.94)	0.00	3.01(1.64-5.52)	0.00
<02 hours/day	1		1	
Screen time (computer/video game)				
≥02 hours/day	3.02(1.7-5.34)	0.00	2.47(1.4-4.35)	0.00
<02 hours/day	1		1	
Fruit consumption				
<05 days/week	0.74(0.41-1.32)	0.31	-	-
≥05 days/week	1		-	
Vegetable consumption				
<05 days/week	1.16(0.64-2.09)	0.62	-	-
≥05 days/week	1		-	
Alcohol consumption				
Yes	1.6(0.86-2.97)	0.14*	1.4(0.76-2.6)	0.28
No	1		1	
Tobacco consumption				
Yes	0.58(0.08-4.04)	0.58	-	-
No	1		-	
Level of physical activity				
Insufficient (<300 min./week)	0.75(0.35-1.64)	0.47	-	-
Sufficient (≥300min./week)	1		-	

Note: **p*<0.20. Values in bold: *p*<0.05. CI: confidence interval.

DISCUSSION

Our study detected a high prevalence of large UEM consumption, especially on the part of girls. Prevalence of UEM was estimated and eight dietary patterns were observed, six of which were higher than expected. When the UEM were assessed as a group, they were associated with excessive sedentary behavior, regardless of gender.

In our study, we observed consumption of vegetables less than five times a week by 66.3% (*p*<0.00) of the boys. A similar result was identified by the National Health Survey carried out with adolescents, adults and elderly people (*n*=60,202), with prevalence rates between 27.8% and 38.6% (*p*<0.01)[1]. We noticed that among children and adolescents, both the low intake of healthy foods, such as fruits and vegetables, and the excessive consumption of unhealthy foods, such as salty snacks, soft drinks and sweets, have been directly related to health status[1,3,15]. Furthermore, the intake of sweets and their derivatives among students has been increasing[16].

Among schoolchildren from Jequié, BA, the highest prevalence of candy consumption, 27.9% (*p*<0.01), was among girls. Similar results were identified in public high schools, such as those of Juiz de Fora, MG (*n*=804 adolescents), where 26.2% (*p*<0.05) of girls reported consuming sweets[16], while an investigation in Pelotas, located in the South region (*n*=832), found 16% of girls consuming sweets (*p*<0.001)[6]. In our study, although the consumption of snacks and soft drinks did not present statistical significance, other investigations have found a high consumption of snacks and soft drinks by schoolchildren[16], and even two or three unhealthy eating patterns[1,2,17].

Among schoolchildren from Jequié, BA, when analyzing the presence of three UEM – consumption of salty snacks, sweets and soft drinks –, exposure to the aggregate foods was 7.88 times greater for boys (95%CI; 7.87-7.90) and 4.91 for girls (95%CI; 4.87-4.95). It has been observed that students of both genders who consume the combined UEM have a greater chance of becoming ill[15], of not practicing physical activity[1] and of being overweight[16]. Furthermore, they have a high chance of carrying these inappropriate habits from adolescence into adulthood[1,3].

The main influence for inadequate eating habits in adolescence comes from the family and its relationship with weight, appearance and diet, with girls being the most affected by their parents' dietary control, according to a specific literature review[18]. Our findings were in line with the investigations carried out with adolescents who had completed primary education, whose unhealthy eating pattern is positively associated with their mothers who had at least completed primary education, were living in developed regions, did not have breakfast, went to fast-food restaurants or ate food while studying or watching TV[17]. Watching TV is a screen time considered as sedentary behavior among schoolchildren, with prevalence rates between 48.8%[17] and 67%[7].

Among students in Jequié, BA, watching TV for two hours or more per day increases the chance of exposure to UEM in male students (PR: 1.98; 95%CI: 1.01-3.9; $p < 0.05$) and female students (PR: 3.01; 95%CI: 1.64-5.52; $p < 0.00$). It has already been observed that students of both genders spend between two and six screen hours (31.6% - 52.6%)[8] and this time is increased by 13% for students who miss classes in winter and autumn, as demonstrated in a study carried out with children and adolescents from public schools (n=463) in Feira de Santana, BA[19]. Furthermore, teenagers who miss classes also increase the frequency of use of video games[19].

In our study, the use of video games or computers for two hours or more by girls increases the chance of exposure to UEM by 2.47 times (95%CI; 1.4-4.35). Females have a worse food consumption and this variable has shown a positive relationship with screen time; the longer the screen time (such as playing video games), the greater the consumption of foods rich in sugar[20,21]. It is worth highlighting that the consumption of foods with high energy value, such as UEM, without the need for energy, has already become a public health concern[22], given the exposure of adolescents to obesity and associated problems[15,21].

On the other hand, the use of video games can also provide favorable results for the eating pattern of students[9,22]. In the study that used active video games (exergame XBOX3600) as suggestion of physical activity for students, a reduction in the weekly frequency of chocolate, soft drink and popsicle consumption was observed in the intragroup comparison after eight weeks[9]. Therefore, games and digital advice are actions that also improve eating habits and contribute to the prevention of obesity in school children[23].

In general, to understand the consumption of UEM in schoolchildren it is necessary to understand the three main pillars that influence eating behavior, including family, social interaction and social media[21]. It is observed, for example, that while girls are more influenced by social media, especially those dealing with fashion, social interaction stands out among boys, when interacting with friends an increase of UEM consumption occurs[21].

In view of the results found in this study, the importance of understanding the UEM and associated factors is highlighted, in a way that favors the development of public policies that help to improve the dietary pattern of schoolchildren[10]. Therefore, according to a systematic review[24], there is a need to ensure or create actions that aim to the improvement of eating behavior of schoolchildren, especially those with low income, both to reduce intake of foods considered UEM and to increase consumption of healthy foods, for example of fruits and vegetables in this population.

There is already evidence that guidelines, policies and interventions aimed at nutritional re-education for US children and adolescents (n=10,163) have contributed to improving dietary patterns in this population, regardless of sociodemographic factors, food assistance, physical activity level or body weight status ($p<0.01$), according to a comprehensive analysis of temporal trends[10]. Similar results are expected for Brazil[12].

Therefore, this study has as a limitation: the use of a self-reported questionnaire, which may overestimate or underestimate the measurements, even if it has been previously validated and tested. As a strong point, the pioneering study of monitoring risk behaviors in the region stands out, in addition to the innovation in statistical analyses using the aggregation model.

CONCLUSION

The prevalence of sweets consumption was higher among girls, while vegetable consumption was lower among boys. On the other hand, when considering the aggregation of the three UEM (unhealthy eating markers), it was observed that males showed the greatest aggregation compared to females. Among boys, watching TV for two hours or more per day was associated with the disorder, while such outcome occurred among girls, using computers and video games for the same amount of time.

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