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Original Article

Poor nutritional status of fifteen-year-old or younger adolescent mothers enhances the risk of small-for-gestational-age newborns

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ABSTRACT

Introduction: To analyze the factors (socio-demographic, clinical, prenatal care, delivery, postpartum data and anthropometric measures) associated with the birth of small for gestational age newborns.

Methods: A cross-sectional study was performed with 15 years old or younger postpartum adolescents divided into small-for-gestational-age newborn (SGA) and non-small-for-gestational age newborn groups (NSGA). Socio-demographic, clinical, prenatal care, delivery, postpartum data and anthropometric measures (triceps skinfold (TS), and mid-arm circumference, (MAC)) were collected.

Results: 8,153 women gave birth at the obstetric ward and 364 (4.46%) ≤ 15 years old adolescents were enrolled in the study. The proportion of SGA newborns was 34.61%. The SGA group attended fewer prenatal visits ($p = 0.037$), had a higher prevalence of nutritional status classified as "very low weight" ($p < 0.001$) and vaginal delivery ($p = 0.023$), compared to the NSGA group. The nutritional status and vaginal delivery remained significant even after adjustment for confounders. The prevalence risk for SGA birth was 30% higher in the group of mothers with nutritional status classified as "very low weight" (odds ratio 1.30, 95% confidence interval 1.13 to 1.50) ($p < 0.001$).

Conclusions: 15.4% of adolescents ≤ 15 years of age had an arm circumference compatible with the "very low weight" condition, demonstrating the high prevalence of poor maternal nutritional status in this group. The birth of SGA among adolescents ≤ 15 years of age is independently associated with maternal nutritional status classified as "very low weight" by the mid-arm circumference measures (MAC).

Keywords: *Small for gestational age; Intrauterine growth restriction; Low birthweight; Teenage pregnancy; Nutritional status*

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INTRODUCTION

Adolescence is an evolutionary step characterized by biopsychosocial development, bound in the second decade of life, between 10 and 19 years of age[1,2]. The growing proportion of sexually active adolescents has resulted in an increasing pregnancy rate[3]. Although fertility rates in adolescents seem to be globally decreasing, about 18 million girls under 20 give birth each year and two million of them are under 15 years old[4]. In Brazil, the percentage of teenage mothers in 2010 was 19.3%, with regional variations. In the North Region (Brazilian Amazon), this proportion was 26.3% and the state of Pará showed 27.4%[5].

Teenage pregnancy is a worldwide public health problem, especially in those countries in development[6,7]. In addition to the impact on mothers' social status and health (anemia, preeclampsia, postpartum hemorrhage, maternal death) the incidence of prematurity, low birthweight (LBW), intrauterine growth restriction (IUGR) and neonatal death are increased[3,6,8]. The age of 15 is considered a cutoff point to increased risk for these outcomes[8], particularly the most serious, such as extremely premature, very low birthweight and neonatal death[1,9]. Many authors have analyzed the association between teenage pregnancy and adverse outcomes on the newborns' health[10-12]. Through the use of population databases[8] and a systematic review[13], findings show a higher prevalence and risk, mainly at the age of 15 or less[3,8,9,13-15]. The effect of teenage pregnancy on public health is reflected by indicators, in which birth is the leading cause of hospitalization of adolescent women in the Brazilian Unified Health System (SUS)[5].

Adolescence is considered especially vulnerable stage in life in nutritional terms, due to the higher demand of nutrients for physical development and body growth[2,16]. If pregnancy occurs in adolescence, the gestational process dramatically increases the risk of the development of nutritional deficiencies, with serious health consequences[2,16]. Birthweight and prematurity are affected substantially by the mother's health and nutritional status[17]. Birthweight is an indicator of pregnancy conditions and fetal development. LBW is a strong predictor of perinatal mortality and morbidity, associated with prematurity or intrauterine growth restriction (IUGR)[18,19]. Small for gestational age (SGA) is an indicator of IUGR[20]. These terms are not synonymous; SGA is represented by birthweight below the 10th percentile for gestational age[21,22].

The incidence of SGA is variable and dependent on the population, the definition and the diagnostic procedures available, ranging from 2.0% to 10.0%. Five percent of all SGA infants present high risk of death in the neonatal period, childhood and adulthood[23]. In developing countries, expressive rates of newborns with LBW have intrauterine growth restriction (IUGR)[24]. The higher the prevalence of SGA, the greater is the proportion of IUGR[21]. The reasons for the higher incidence of SGA among teenage mothers aged 15 or less are not clearly established. This relationship is probably due to inadequate prenatal care[14,15], biological immaturity[3], competition for nutrients between mother and fetus[1,2] and maternal malnutrition[16,25,26].

The nutritional status in early pregnancy, low maternal weight gain and low maternal height are the factors most associated with IUGR, and are considered as possible maternal malnutrition indicators[16,25]. The body mass index (BMI) adjusted to pregnancy is used to evaluate the gestational nutritional status. However, the triceps skinfold (TS) has a better correlation with the percentage of body fat, and is a good indicator of energy reserve[27]. The Frisancho scale is a simple method of nutritional state assessment, based on the brachial circumference, which has been associated with adverse gestational outcomes[25,28].

Based on the risk of conception to maternal and child health, the public health impact and the need for a different approach to adolescent pregnancy, this study examines which factors are associated with the birth of SGA in the group of teenage mothers aged 15 years old or less.

METHODS

A cross-sectional study was conducted in Belém, capital of the state of Pará, in the northern region of Brazil, in the obstetric ward of the Hospital da Santa Casa de Misericórdia do Pará (HSCMPA). This institution serves only patients from the Unified Health System (SUS) and is a reference for high-risk pregnancies. The research project was approved by the Ethics Committee in Research of the HSCMPA under the protocol #180/11.

Adolescents 15 years old or younger and their newborns (singleton pregnancies) were studied from February 2012 to March 2013. A total of 364 postpartum adolescent mothers aged 15 years or less were enrolled. The person responsible for the patient signed the informed consent forms, and the patient signed the term of assent forms before data collection. Clinical data were collected from the prenatal card. The triceps skinfold (TS) and mid-arm circumference (MAC) measures were performed using a standardized technique in the immediate puerperium with a clinic adipometer (Lange, Diversey, Fort Mill South Carolina, USA). Data of birth and neonatal events were collected from the patient and the neonate records.

The main study outcome was the birth of SGA newborns. SGA newborns were considered those with a birthweight below the 10th percentile, using the weight curve at birth according to the gestational age percentile chart[29].

The maternal variables were: maternal age (years); marital status (with partner, without partner); maternal education (years of school); family income (in categorizing ≤ 1 and > 1 minimum wage [R$ 622.00]); smoking (cigarette exposure in all or part of gestation period, regardless of the daily amount); alcohol and illicit drugs (considering exposure in total or partial period of gestation, independent of the daily amount); teenager's mother's age at first pregnancy; age of the newborn's father (in years and categorized into ≤ 19 or > 19); newborn's father's schooling (years); diseases and medications prior to pregnancy; age at menarche (years); age at first sexual intercourse (years); gynecological age in early pregnancy (in years); use of contraceptive methods; parity; prenatal visits (categorizing 0–3, 4–6 and > 6); complications in pregnancy (oligohydramnios, vulvovaginitis, gestational hypertension [preeclampsia, eclampsia, gestational hypertension without preeclampsia], premature rupture of membranes, urinary tract infection, anemia, premature labor, syphilis during pregnancy, intrauterine fetal death, third trimester bleeding [placenta previa, placental abruption]) mode of delivery (vaginal or cesarean section) and complications in childbirth and postpartum.

Newborns' gestational age was classified by the Capurro method[30] categorizing as premature those born before 37 weeks and as full-term newborns those born > 37 and < 41 weeks. Newborns were classified as LBW when they weighed less than 2,500 grams.

The maternal nutritional status was avaliated using MAC and TS. The TS was measured in milimeters with a clinic adipometer, positioning it at half-distance between the acromion and the olecranon process, in the posterior portion of the non-dominant arm. The MAC was measured in centimeters with an inelastic tape at the midpoint of the non-dominant arm extended. For interpretation and categorization of the nutritional status the value found in anthropometry was applied to the Frisancho percentile table, using the cutoff points predefined by the author. The adolescents' TS were classified as: "very low weight" when presenting ≤ 5th percentile values; "thin" ≥ 5.1–15th; "medium" ≥ 15.1–75th; "high adiposity" ≥ 75.1–85th and "excessive fat" > 85th percentile values. In the classification of MAC, the adolescents were classified as: "very low weight" when presenting ≤ 5th percentile values; "low weight" ≥ 5.1–15th; "medium" ≥ 15.1–85th; "high weight" ≥ 85.1–95th; "excessive weight" > 95th percentile values[28].

The sample size was calculated from a pilot study conducted at the same hospital with teenage mothers less than 15 years old. Considering an odds ratio of 1.5 for SGA (1.45 to 1.56)[8], a power of 80%, α error = 0.05%, we calculated a sample of 302 patients. To replace losses the sample was increased over 20%, resulting in 362 participants.

The chi-square test was used to compare categorical variables and Student's *t* test to compare continuous variables (bivariate analyses). Multivariate analysis was performed using Poisson regression, adjusting for confounding factors (nutritional status [MAC], prenatal care visits, smoking in pregnancy, fathers age and mode of delivery). All variables in the bivariate analysis with $P \leq 0.20$ and likelihood of association acknowledged in most studies were included. A *P value* ≤ 0.05 was considered to indicate statistical significance in multivariate analysis. Statistical analysis was performed using the *Statistical Package for Social Sciences* (SPSS) version 18.

RESULTS

In the period of data collection, 8,153 women gave birth at the obstetric ward of the Hospital da Santa Casa de Misericórdia do Pará, and from this total, 32.72% (n = 2,668) were adolescents aged up to 19 years and 5.97% (n = 487) aged up to 15 years. A total of 123 teenagers were excluded because: there was no legal responsible guardian present to authorize the participation in this project or the teenager refused to participate; or the responsible guardian was not able to read and write; or the teenager had some mental disability or had a severe obstetric complication.

Therefore 364 adolescent mothers aged below or equal to 15 years and with a single pregnancy participated in the survey. The age of the adolescents ranged between 11 and 15 years, with a mean of 14.46 ± 0.78 years old. Teenage mothers and their newborns were divided into two groups according to the diagnosis of SGA and non-SGA (NSGA). The SGA group comprised 126 (34.61%) and the NSGA group comprised 238 (65.38%) newborns (Table 1).

Table 1: Sociodemographic profile and characteristics of prenatal care, delivery, puerperium of adolescents and profile of newborns from adolescent mothers at the Santa Casa de Misericórdia of Pará.

Variables	SGA (n = 126)	%	NSGA (n = 238)	%	p
Maternal age – years[a,b]	14.52 ± 0.74		14.43 ± 0.80		0.336
Marital status[a,b]					
With partner	96	76.2	167	70.2	0.222
Without partner	30	23.8	71	29.8	
Mother's education – years[a,b]	4.7 ± 1.65		4.8 ± 1.72		0.577
Clinical pathologies[a]					
Yes	11	8.7	27	11.3	0.438
No	115	91.3	211	88.7	
Use of medication previous to pregnancy[a]					
Yes	7	5.6	13	5.5	0.970
No	119	94.4	225	94.5	

Continua...

Tabela 1: Continuação.

Variables	SGA (n = 126)	%	NSGA (n = 238)	%	p
Menarche – years[b]	11.8 ± 1.1		11.6 ± 1.1		0.250
First intercourse – years[b]	13.2 ± 1.1		13.1 ± 1.0		0.687
Gynecological age at pregnancy – years[b]	2.6 ± 1.1		2.7 ± 1.4		0.585
Use of contraceptive method[a]					
Yes	61	48.4	117	49.1	0.892
No	65	51.6	121	50.8	
Family income – minimum wage[a]					
≤ 1 salary	82	65.0	156	65.5	0.951
> 1 salary	44	35.0	82	34.5	
Age of mother in the 1st pregnancy – years	17.96 ± 2.90		17.84 ± 2.89		0.705
NB father age – years	20.85 ± 3.54		21.33 ± 4.03		0.263
NB father age[a]					
≤ 19 years	54	42.9	86	36.2	0.189
> 19 years	69	54.8	148	62.2	
SI	3	2.3	4	1.6	
NB father education – years[b]	6.5 ± 2.55		6.82 ± 2.23		0.241
Parity[a]					
1	117	92.9	219	92.1	0.775
≥ 2	9	7.1	19	7.9	
Prenatal care visits[a]					
0–3	87	69.1	134	56.3	0.037
4–6	33	26.1	87	36.5	0.060
> 6	6	4.8	17	7.2	
Smoking in pregnancy[a]					
Yes	2	1.6	8	3.3	0.325
No	124	98.4	230	96.7	
Alcohol consumption during pregnancy[a]					
Yes	2	1.6	8	3.3	0.325
No	124	98.6	230	96.7	
Illicit drug during pregnancy[a]					
Yes	0	0	3	1.2	0.206
No	126	100	228	95.8	
Pathology in the current pregnancy[a]					
Yes	109	86.5	201	84.5	0.600
No	17	13.5	37	15.5	
Mode of delivery[a]					
Vaginal	78	61.9	117	49.2	0.020
Caesarean section	48	38.1	121	50.8	
Delivery and puerperium's complications[a]					
Yes	55	43.7	132	55.4	0.032
No	71	56.3	106	44.6	

[a]X^2 test; [b]Student's *t* test; mean ± standard deviation (SD).

There was no difference in the average age of mothers in the SGA group and the NSGA group. Among the mothers of the SGA group, 76.2% reported living with the newborn's father. There was no significant difference between groups in mean schooling and cigarette smoke exposure during pregnancy (Table 1). The mean age at menarche, first intercourse, gynecological age, and prevalence of contraceptive use were similar in both SGA and NSGA groups. Clinical history and use of medication prior to pregnancy did not differ between groups (Table 1).

The categorized family income in minimum wages did not differ between groups, with 65% of respondents reported income ≤ 1 salary.

Analyzing the history of teenage pregnancy in the family, it was verified that the average age of mothers of adolescents in the first pregnancy was 17.96 ± 2.90 years old in the SGA group and 17.84 ± 2.89 in the NSGA group. The mean age of the adolescents' partners and their education did not differ significantly. The number of years of education of the partners in both groups was not different (Table 1).

There was no difference in the percentage of first pregnancy between the groups. Lack of prenatal or a small number of prenatal visits (≤ 3 in total) was significantly more prevalent in the SGA than the NSGA. There was no significant difference in the rate of clinical complications during pregnancy in both groups. The SGA group showed a higher proportion of vaginal delivery and a lower frequency of complications during labor and delivery (Table 1).

Both TS and MAC were significantly different between groups. The average MAC was also significantly lower in the SGA group (22.9 ± 2.4 vs. 24.0 ± 2.2 cm NSGA) ($p < 0.001$). The average TS in the SGA group was lower (13.0 ± 3.8 mm) than in the NSGA group (14.5 ± 4.0 mm) ($p = 0.001$). The prevalence of "very low weight" newborns in the SGA group was 25.4% (32), according to the Frisancho classification (MAC) (Figure 1A), while in the NSGA group the prevalence of "very low weight" was 0.8% (19) (TS) ($p = 0.005$) (Figure 1B).

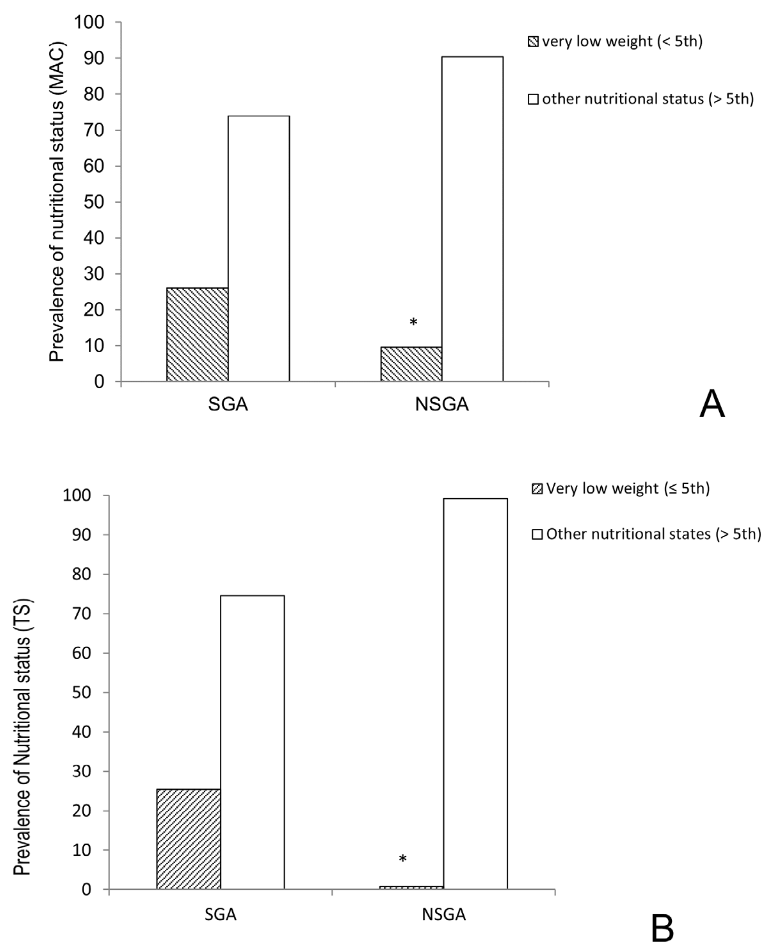

Figure 1: Prevalence of diagnosis of newborns' nutritional status according to Frisanscho (A) and TS (B).

*p value = < 0.05, SGA vs. NSGA.

Regarding the profile of NBs, most of the SGA group (69.9%) were ≥ 37 weeks of gestational age and 30.1% was associated with prematurity. In the NSGA group, 78% (186) were term pregnancies and 22.2% (52) were premature (< 37weeks). The gestational age variable was not statistically significant ($p = 0.098$) between groups. Regarding birthweight, most of the SGA newborns (62%, (78) weighed less than 2500 g (LBW), while in the NSGA group this proportion was 18% (43), resulting in a statistically significant difference between the groups ($p < 0.001$).

Multivariate analysis was performed between the outcome – SGA birth – and maternal variables significant in the bivariate analysis ($p \leq 0.20$) and likelihood of association recognized in other studies. The nutritional status (MAC), number of prenatal visits, smoking, newborn father's age and mode of delivery variables were included in the multivariate model. TS measures, though statistically significant, were not included in the analysis due to the multicollinearity interaction with MAC (Table 2).

Table 2: Multivariate analysis.

Variables	N	Prevalence (%)	PR (CI95%)	p#
Nutritional status (MAC)				
Very low weight	56	15.4	1.30 (1.13–1.50)	< 0.001
Other nutritional status	308	84.6		
Prenatal care visits				
0–3	221	60.7	1.08 (0.90–1.30)	0.389
4–6	120	33.0		
> 6	23	6.3		
Smoking in pregnancy				
Yes	10	2.8	1.14 (0.91–1.41)	0.243
No	354	97.2		
NB fathers age years				
≤ 19	140	38.4	0.99 (0.98–1.00)	0.349
> 19	217	59.6		
Mode of delivery				
Vaginal	195	53.5	1.11 (1.01–1.22)	0.023
Caesarean section	169	46.4		

Poisson regression; PR: prevalence risk; CI: confidence interval; $p < 0.05$.

After the Poisson regression, adjusting for confounding factors, only nutritional status and mode delivery remained significant ($p < 0.001$ and $p = 0.023$) different between SGA and NSGA group. Prevalence of SGA newborns was 30% higher in adolescents with nutritional status compatible with "very low weight" on the Frisancho scale (MAC) (OR 1.30, 95% CI 1.13 to 1.50; $p < 0.001$).

DISCUSSION

This study was performed with obstetrics patients of the Hospital da Santa Casa de Misericórdia do Pará (HSCMPA) in Belém, capital of the state of Pará, in the northern region of Brazil. The obstetric ward of the HSCMPA is the reference for high-risk pregnancies in the state, explaining, in part, the large proportion of teenage mothers aged ≤ 15 years (5.97%), when compared to 4.1% in the state of São Paulo in the southeastern region of Brazil[12], 4.2% in the state of Acre in the northern region of Brazil[31], 3.9% in Latin American[8] and 0.8% in Portugal[32].

In the Brazilian system of data on live births (SINASC), the birth rate has been decreasing in the overall population in the last decade. However, among adolescents the decrease in the birth rate is not significant. In younger teenagers, numbers are stable or increasing in some regions[5], recurrence of teenage pregnancy is also associated with a maternal age and inadequate education for their age[33], and these population are at the highest risk of adverse perinatal outcomes[3,8,9,11].

In our sample, the prevalence of SGA was 34.6%. Possibly, this finding is due to the specialized service in high-risk pregnancy. In the study by Conde-Agudelo, Belizán, and Lammers[8], the prevalence of SGA in Latin America was 17%, for teenagers up to 15 years old. In other researches the prevalence of SGA and LBW were also below our findings in adolescents[12,14,15].

Campbell et al.[20] demonstrated that maternal smoke exposure during pregnancy increased by five times the chance of SGA NBs. This association was not found in our study, probably because of a low prevalence of smoking habit in this young adolescent population. The risk of SGA seems to be 2.3 times and 7% higher among women who smoked or had stopped smoking during the first trimester of pregnancy compared to nonsmokers[34].

The average number of prenatal visits was inadequate in both groups. Only 4.8% of SGA group and 7.2% in NSGA group had more than six prenatal visits, the minimum recommended by the Brazilian Ministry of Health. Conde-Agudelo, Belizán, and Lammers[8] demonstrated that in Latin America 23.5% of pregnant teenagers up to 15 years old had no prenatal visits.

A tendency towards an association of vaginal delivery with a SGA outcome was found and was in accordance with the study from Zhang et al.[35] in more than 238,000 singleton pregnancies in women aged 10–34 years. The group of adolescents (aged 10–19 years) had lower risk of cesarean delivery.

The largest retrospective Latin America cohort study of pregnancy in adolescents[8] with a maternal age < 15 years old was associated with a 50% increase in SGA newborns and a lower risk of cesarean section. The cesarean rate was higher in our study, 38.1% and 50.8% in SGA and NSGA group, respectively.

The impact of poor nutritional status in pregnancy makes it one of the most relevant factors associated with an increased risk of adverse perinatal outcomes[3,25,36]. The BMI, classified as underweight in early pregnancy, was associated with SGA birth, and late in pregnancy a BMI ≤ 18.5 seems to increase SGA births by 40%[20]. Furlan et al.[25], evaluating the association between nutritional status and weight of newborns using pre-pregnancy BMI and BMI at the end of pregnancy, found that 75% of patients with BMI compatible with undernutrition in late pregnancy gave birth to infants with LBW (< 2,500 g). In our study, the nutritional status of adolescent mothers was evaluated after childbirth using anthropometric measures (TS and MAC), and seems to be due to factors such as lack of prenatal care, late onset, low number of prenatal visits, few records of BMI in early pregnancy or subsequent prenatal visits. The MAC is an anthropometric assessment that easily identifies "very low weight adolescents" (Frisancho scale)[28] and, in our study, after multivariate analyses, was associated with SGA newborns ($p < 0.001$).

Kassar et al.[37] analyzed the association between MAC and birthweight and concluded that women with a MAC less than 25 cm delivered children with a mean birthweight 76 g lower ($p = 0.002$), and in adolescents ≤ 15 years old with a MAC up to 25 cm, the mean weight of newborns was 203 g lower.

The lack of pre-natal records is the weakness of our study, and other nutritional data (height, first weight and weight gain in pregnancy) could not be analyzed. However, the strength point is the discussion about improvement in adolescent health care in low income areas with a simple method to identify adolescent mothers with increased risk of adverse perinatal and neonatal events. More studies with MAC in pregnant adolescents are necessary to discuss the improvement of adolescent health care, in the sense of sex education, prevention of teenage pregnancy and correction of deviations in nutritional status, from the beginning of pregnancy.

In conclusion, the measurement of arm circumference (MAC), as preconized by Frisancho et al., identified 25.4% of poor maternal nutritional status in a young adolescent group (≤ 15 years). The "very low weight" by the mid-arm circumference measure was significantly and independently associated with SGA newborns. The measurement of brachial circumference is easy to perform, low cost and available in all health services. Its achievements may allow the identification of young adolescents mothers with a higher risk of adverse SGA, enabling the prevention of adverse outcomes with lifelong repercussions for mother and child.

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