**Research Article**

# The Pregnancy-Specific Stress How Factor Risk for Preterm Birth

**J. Jesús Pérez-Molina[1,3*], Aleyda Carolina Barajas-Serrano[1], Andrés Palomera-Chávez[4], J. Guadalupe Panduro-Barón[2,3], Norma Argelia Quezada-Figueroa[3], Guillermo Yanowsky-Reyes[3], Jaime Orozco-Pérez[3]**

[1]Division of Pediatrics, Hospital Civil de Guadalajara "Dr. Juan I. Menchaca ", Guadalajara, Jalisco, México

[2]Division of Gynecology and Obstetrics, Hospital Civil de Guadalajara, "Dr. Juan I. Menchaca ", Guadalajara, Jalisco, México

[3]Department of Clinics of Human Reproduction, University Center of Health Sciences, University of Guadalajara, Guadalajara, Jalisco, México

4Department of Basic Psychology, University Center of Health Sciences, University of Guadalajara, Guadalajara, Jalisco, México

\***Corresponding author:** J. Jesús Pérez-Molina, Division of Pediatrics Office (third floor), Hospital Civil of Guadalajara "Dr. Juan I. Menchaca ", Salvador Quevedo and Zubieta 750, Colonia la Perla, Guadalajara, Jalisco, C.P. 44340, México. Tel: 52- 3336178738/ 3637 5018; Email: jesusperezmolina@gmail.com

## Abstract

Preterm birth (PB) has a multifactorial etiology and psychosocial stress can be a risk factor. Objective. Quantify the association of the specific stress of pregnancy with PB. Material and methods. A case-control study was conducted in 254 preterm mother-child dyads and 254 term dyads, between 2010 and 2011, at the Civil Hospital of Guadalajara. The dependent variable was PB (24-36 weeks of gestation) and the independent stress specific to pregnancy. Gestational age was confirmed with the Capurro and Ballard methods. The specific stress of pregnancy was sought by direct interview. We inquired about psychosocial, obstetric and illicit drugs. The association was evaluated with logistic regression. Results. The age of the mothers was 25 ± 6 years. The frequency of psychosocial factors and drug use was similar. In the bivariate analysis were more frequent in PB, antecedent of PB (OR: 1.98, CI95%: 1.17-3.36), diseases in pregnancy (OR: 1.49, CI95%: 1.03-2.17), multiple pregnancy (OR: 14.72, CI95%: 4.28-60.63), being born by caesarean section (OR: 4.93, CI95%: 3.26-7.48, worrying about work and family care (OR 1.60, CI95% 1.01-2.55) and paying for clothes, food and medical expenses of the baby (OR 1.55, CI95% 1.00-2.39). A multivariate model identified as covariates associated with PB to worry a lot about the care of the new baby (OR 2.58, CI95% 1.21-5.47) and to be born by caesarean section (OR 5.59, CI95% 2.63-11.90). Discussion and conclusion. Of the variables related to specific stress of pregnancy, only worry much about the care of the baby was associated with PB, as well as being born by cesarean section. Keywords: preterm birth, pregnancy, psychosocial stress

**Keywords:** Pregnancy; Preterm Birth; Psychosocial Stress

## Abbrevations

| | | |
|---|---|---|
| CI | : | Confidence Interval |
| LMP | : | Last Menstrual Period |
| HCGJIM | : | Hospital Civil De Guadalajara "Dr. Juan I Menchaca" |
| NB | : | Newborn |
| OR | : | Odds Ratio |
| PB | : | Preterm Birth |
| PROM | : | Premature rupture of amoniotic membranes |

## Introduction

Preterm birth (PB) is the product born before 37 weeks of gestation or 259 days from the first day of the last menstrual period (LMP) the PB rate in the US is 12.5%, affects 500,000 births per year and is related to 75-80% of perinatal deaths. In Mexico, the PB rate is 8% to 12% [1]. The PB has a multifactorial etiology and

among the risk factors involved in its etiology, psychosocial stress during pregnancy has been identified as a variable of interest [2,3]. It has been mentioned that maternal stress contributes to preterm birth by the dysfunction of neuroendocrine, immune, inflammatory and vascular processes that are modifiable by stress and that participate in the physiology of labor and can trigger its onset before the end. However, much of the research [4-5] has studied the non-specific stress of pregnancy such as emotions during pregnancy especially anxiety, and stressful prenatal conditions such as serious life events, for example the death of a family member. and catastrophic events in the community, among others [4]. A more recent approach to measuring prenatal stress focuses on the specific stress of pregnancy that arises from specific pregnancy issues and includes its symptoms, parental concern, interpersonal relationships, bodily changes, work-related anxiety and childbirth and concerns about the baby's health, and it has been shown to be a better predictor for PB than anxiety, perceived stress, and serious life events. Because the specific stress of pregnancy can be modified by the influence of local variables, the objective of this study was to investigate whether it is associated more frequently with PB in a public hospital in western Mexico [5].

## Material and Method

A case-control study was conducted in the population constituted by all births from May 2010 to June 2011, at the Hospital Civil de Guadalajara "Dr. Juan I Menchaca" (HCGJIM) which provides health services to urban population, open, with limited economic resources, low educational level and no social security [6]. The sample was constituted with all the mother-child dyads from 24 to 36 weeks of gestation collected consecutively and a control group from 37 to 41 weeks of gestation selected in a simple random manner. To collect information related to the specific stress of pregnancy one of the researchers (ACBS) was trained and standardized by a certified psychologist to interview mothers about the variables related to the specific stress of pregnancy as suggested by Lobel, et al. and to evaluate the gestational age of Newborns (NB) with the assessments of Capurrro and Ballard modified, the researcher was trained and standardized with a certified neonatologist; All the standardizations were carried out until almost perfect concordance between two observers [5,7-8]. The data were collected prospectively by direct interview with the mothers of the cases and the controls in the first 24 hours after the birth of the newborns. The pregnancy-specific psychosocial stress measurement instrument [5] included the following questions: 1) for the effects on your health such as blood pressure or diabetes in your pregnancy and / or some other illness, 2) for feeling tired and with little energy during your pregnancy, 3) for the payment of medical expenses during pregnancy, 4) for the changes in the weight and shape of your body, 5) for the possibility of having a baby with health problems, 6) for the physical symptoms of the pregnancy

such as vomiting, leg swelling or colic, 7) for the quality of the medical service during pregnancy, 8) for your work and the care of your family during pregnancy, 9) for the possibility of having a preterm birth, 10) for changes in relationships with people after having a baby, 11) for paying for clothes, food and medical expenses for the baby, 12) about the care you will have with the new baby, 13) about pain during labor of childbirth, 14) about caring two diaries, nannies and another help to monitor the baby after birth.

Each question was asked, how you have felt tired, sad or worried in your pregnancy before having your baby; and to which the interviewees responded as: no, a little or something or a lot. The mother was also asked about her marital status, occupation, unsafe housing, schooling, socioeconomic status, drug use during pregnancy, maltreatment during pregnancy, date of onset of LMP, history of PB, prenatal care and diseases during the pregnancy. On the same day of the interview, information related to premature rupture of amniotic membranes (PROM), mode of birth and laboratory results relevant to the investigation was obtained from the clinical file. The gestational age was calculated with the days elapsed from the first day of the LMP obtained by direct interview. Also, all the NB were evaluated for gestational age by physical examination as follows: with the modified Capurro assessment, when the neonates had >29 gestation weeks; and with the valuation of Ballard, when the NB were ≤ 29 gestation weeks. When there was a difference of more than two weeks between the gestational age calculated by LMP and that measured by Capurro or Ballard, and when the mother did not remember the LMP, the gestational age obtained by Capurro or Ballard was taken as definitive. Prenatal care was evaluated by the number of consultations in relation to the moment of pregnancy, expressed in weeks of pregnancy. The socioeconomic status was evaluated using the Álvarez et al. scale, which takes into account schooling, housing characteristics and work activity of the head of the family and the mother [9-10]. The information was captured in a spreadsheet with the Excel 2007 program. A pilot test was carried out to collect and capture information before the final one, to detect and correct errors.

The quantitative variables were calculated mean and standard deviation and compared with Student's t test for two independent samples; the qualitative ones were compared with proportions and compared with the x2 or Fisher's exact test as necessary. The association between stress with PB and the confounding effect was measured with Odds Ratio (OR) by logistic regression with the forced introduction method. The good fit of the model was verified with the Hosmer and Lemeshow test. In all calculations, the confidence interval was 95% (95% CI). The analyzes were carried out with the statistical program for social sciences (SPSS Statistics for Macintosh, Version 22.0, Armonk, NY: IBM Corp.) This research was approved by the Research and Ethics Committees of the Hospital headquarters registration 991/10), the mothers signed a written informed consent to participate in the study.

## Results

During the study period, enough information was collected for the research in 254 preterm mother-child dyads and in 254 mother-child dyads for the term, no mother-child dyad was eliminated. The gestational age of PB was $34.7 \pm 2.2$ and of the NB term $38.9 \pm 1.4$ weeks. Mean age of the mothers ($25 \pm 6$ vs $24 \pm 6$ years, p = 0.183), maternal education ($8 \pm 2$ vs $8 \pm 2$ years of study, p = 0.409), the monthly economic income of the family ($3,653 \pm 1619$ vs $3,624 \pm 1,746$ Mexican pesos, p = 0.902), the age of the parents ($27 \pm 7$ vs $27 \pm 7$ years, p = 0.487) and the parents' schooling ($8 \pm 3$ vs $8 \pm 3$ years of study, p = 0.837) were similar. Also, the frequency of attending school, perceived rejection by family and friends, drug use during pregnancy and being single, were distributed in a similar way in the two study groups (Table 1).

| Variables | Preterm births | | Term births | | OR (CI 95%) | P |
|---|---|---|---|---|---|---|
| | n/N | % | n/N | % | | |
| Single [1] | 38/254 | 15 | 46/254 | 18 | 0.80(0.48-1.31) | 0.339 |
| He left school[2] | 16/254 | 6 | 10/254 | 4 | 1.64(0.69-3.97) | 0.227 |
| Worked in pregnancy[2] | 30/254 | 12 | 28/254 | 11 | 1.08(0.60-1.93) | 0.78 |
| Rejection by the couple[2] | 26/254 | 10 | 36/254 | 14 | 0.69(0.39-1.22) | 0.175 |
| Rejection in the family [2] | 19/254 | 7.5 | 17/254 | 6.7 | 1.13(0.54-2.34) | 0.729 |
| Rejection by friends [2] | 35/254 | 14 | 31/254 | 12 | 1.15(0.66-1.99) | 0.597 |
| Smoked 1st trimester[2] | 15/254 | 6 | 13/254 | 5 | 1.16(0.51-2.66) | 0.697 |
| Smoked 2nd trimester[2] | 4/254 | 2 | 8/254 | 3 | 0.49(0.12-1.83) | 0.242 |
| Smoked 3rd trimester[2] | 4/254 | 2 | 3/254 | 1 | 1.34(0.25-7.60) | 0.5 |
| Alcohol 1er trimester[2] | 7/254 | 3 | 11/254 | 4 | 0.63(0.22-1.78) | 0.337 |
| Alcohol 2º trimester[2] | 5/254 | 2 | 4/254 | 2 | 1.26(0.29-5.63) | 0.5 |
| Alcohol 3er trimester[2] | 1/254 | 0.4 | 3/254 | 1 | 0.33(0.01-3.57) | 0.311 |
| Illicit drugs 1st trimester * [2] | 1/254 ** | 0.4 | 1/254 *** | 0.4 | 1.00(0.00-36.73) | 0.75 |

[1] Single, separated and divorced vs. married and in free union; [2] yes vs. do not

NB: Newborn. OR: Odds Ratio. CI: Confidence Interval. P: p-value when comparing proportions with chi-square or Fisher's exact test.

* Illicit drugs were consumed only during the first trimester of pregnancy.

** Tonsil. *** Marijuana.

**Table 1:** Psychosocial Variables and Drug Use During Pregnancy in The Study Groups.

The most frequent obstetric factors in preterm mother-child dyads were: previous spontaneous PB (50/254, 20% vs 28/254, 11%, p = 0.006), diseases during pregnancy (168/254, 66% vs 144 / 254, 57%, p = 0.028), multiple pregnancy (38/254, 15% vs 3/254, 1%, p = <0.001), PROM> 24 h (31/254, 12% vs 5/254, 5%, p = <0.001) and being born by caesarean section (139/254, 58% vs 50/254, 20%, p = <0.001). Similarly, in the bivariate analysis, the aforementioned variables were associated with a higher frequency of PB (Table 2).

| Variables | Preterm births | | Term births | | OR (CI 95%) | P |
|---|---|---|---|---|---|---|
| | n/N | % | n/N | % | | |
| Antecedent of PB spontaneous [1] | 50/254 | 20 | 28/254 | 11 | 1.98(1.17-3.36) | 0.006 |
| Pregnancy no planned [1] | 124/254 | 49 | 112/254 | 44 | 1.21(0.84-1.74) | 0.285 |
| Diseases in the pregnancy [1] | 168/254 | 66 | 144/254 | 57 | 1.49(1.03-2.17) | 0.028 |
| Multiple pregnancy [1] | 38/254 | 15 | 3/254 | 1 | 14.72(4.28-60.63) | < 0.001 |
| Prenatal care | 183/254 | 72 | 193/254 | 76 | 1.23 (0.81-1.86) | 0.311 |
| PROM ≥ 24 hours [1] | 31/254 | 12 | 5/254 | 5 | 6.92 (2.51-20.64) | < 0.001 |
| Cesarean [1] | 139/254 | 58 | 50/254 | 20 | 4.93 (3.26-7.48) | < 0.001 |

[1]Yes vs. do not.

NB: Newborn. OR: Odds Ratio. CI: Confidence Interval. P: p value when comparing the proportions with square chi or Fisher's exact test. PROM: premature rupture of amniotic membranes.

**Table 2:** Obstetric factors in the study groups.

The most frequent responses related to pregnancy-specific stress in the mothers of PB were to worry about the work and care of the family during pregnancy (72/216, 35% vs 46/183, 25%, p = 0.035) and worry about paying for clothes, food and medical expenses for the baby (90/191, 47% vs 68/186, 37%, p = 0.037). Also, in the bivariate analysis, these two variables were associated with a higher frequency of PB (Table 3).

| Variables | Preterm births | | Term births | | OR CI (95%) | P |
|---|---|---|---|---|---|---|
| | n/N | % | n/N | % | | |
| For the effects on your health such as blood pressure or diabetes in your pregnancy | | | | | | |
| No | 157/254 | 62 | 168/254 | 66 | | |
| Something [1] | 51/208 | 25 | 52/220 | 24 | 1.05 (0.66-1.67) | 0.83 |
| A lot [2] | 46/203 | 23 | 34/202 | 17 | 1.37 (0.82-2.29) | 0.207 |
| For feeling tired and with little energy during your pregnancy | | | | | | |
| No | 74/254 | 29 | 92/254 | 36 | | |
| Something [1] | 117/191 | 61 | 101/193 | 52 | 1.44 (0.94-2.21) | 0.077 |
| A lot [2] | 63/137 | 46 | 61/153 | 40 | 1.28 (0.78-2.10) | 0.293 |
| For the payment of medical expenses during pregnancy | | | | | | |
| No | 126/254 | 49 | 120/254 | 47 | | |
| Something [1] | 69/195 | 35 | 68/188 | 36 | 0.97 (0.62-1.50) | 0.872 |
| A lot [2] | 59/185 | 32 | 66/186 | 35 | 0.85 (0.54-1.34) | 0.462 |
| By changes in the weight and shape of your body | | | | | | |
| No | 158/254 | 62 | 174/254 | 68 | | |
| Something [1] | 62/220 | 28 | 47/221 | 21 | 1.45 (0.92-2.30) | 0.092 |
| A lot [2] | 34/192 | 18 | 33/207 | 16 | 1.13 (0.65-1.98) | 0.637 |
| Because of the possibility of having a baby with health problems | | | | | | |
| No | 50/254 | 20 | 46/254 | 18 | | |
| Something [1] | 76/126 | 60 | 89/135 | 66 | 0.79 (0.46-1.34) | 0.347 |
| A lot [2] | 128/178 | 72 | 119/165 | 72 | 0.99 (0.60-1.63) | 0.965 |
| Having vomiting, swollen legs or cramping during pregnancy | | | | | | |
| No | 125/254 | 49 | 118/254 | 46 | | |
| Something [1] | 78/203 | 38 | 78/196 | 40 | 0.94 (0.62-1.44) | 0.778 |

| A lot [2] | 51/176 | 29 | 58/176 | 33 | 0.83 (0.51-1.34) | 0.419 |
|---|---|---|---|---|---|---|
| For the quality of the medical service during pregnancy | | | | | | |
| No | 156/254 | 61 | 160/254 | 63 | | |
| Something [1] | 58/214 | 27 | 55/215 | 26 | 1.08 (0.69-1.70) | 0.72 |
| A lot [2] | 40/196 | 20 | 39/199 | 20 | 1.05 (0.62-1.77) | 0.84 |
| For your work and the care of your family during pregnancy | | | | | | |
| No | 134/254 | 53 | 137/254 | 54 | | |
| Something [1] | 72/206 | 35 | 46/183 | 25 | 1.60 (1.01-2.55) | 0.035 |
| A lot [2] | 48/182 | 26 | 71/208 | 34 | 0.69 (0.44-1.09) | 0.096 |
| Because of the possibility of having a preterm birth | | | | | | |
| No | 68/254 | 27 | 81/254 | 32 | | |
| Something [1] | 60/128 | 47 | 69/150 | 46 | 1.04 (0.63-1.71) | 0.884 |
| A lot [2] | 126/194 | 65 | 104/185 | 56 | 1.44 (0.93-2.23) | 0.081 |
| Because of changes in relationships with people after having a baby | | | | | | |
| No | 197/254 | 77 | 194/254 | 76 | | |
| Something [1] | 36/233 | 15 | 43/237 | 18 | 0.81 (0.49-1.36) | 0.399 |
| A lot [2] | 21/218 | 10 | 17/211 | 8 | 1.20 (0.58-2.46) | 0.597 |
| By paying for baby's clothes, food and medical expenses | | | | | | |
| No | 101/254 | 40 | 118/254 | 46 | | |
| Something [1] | 90/191 | 47 | 68/186 | 37 | 1.55 (1.00-2.39) | 0.037 |
| A lot [2] | 63/164 | 38 | 68/186 | 37 | 1.08 (0.69-1.71) | 0.72 |
| About the care you will have with the new baby | | | | | | |
| No | 90/254 | 35 | 105/254 | 41 | | |
| Something [1] | 58/148 | 39 | 64/169 | 38 | 1.06 (0.65-1.71) | 0.809 |
| A lot [2] | 106/196 | 54 | 85/190 | 45 | 1.45 (0.96-2.22) | 0.066 |
| About pain during labor | | | | | | |
| No | 89/254 | 35 | 68/254 | 27 | | |
| Something [1] | 75/164 | 46 | 65/150 | 43 | 0.89 (0.55-1.45) | 0.628 |

| A lot [2] | 90/179 | 50 | 104/189 | 55 | 1.02 (0.64-1.64) | 0.922 |
|---|---|---|---|---|---|---|
| About daily care, babysitters and other help to monitor the baby after birth | | | | | | |
| No | 157/254 | 62 | 165/254 | 65 | | |
| Something [1] | 45/202 | 22 | 50/215 | 23 | 0.95 (0.58-1.53) | 0.811 |
| A lot [2] | 52/209 | 25 | 39/204 | 19 | 1.40 (0.85-2.30) | 0.157 |

[*] The variables were interrogated as: you have felt tired, sad or worried in this moment of your pregnancy? And they were answered as not, something or much.

[1] Worry something vs. not worry, after having excluded who responded worry a lot.

[2] Worry a lot vs. not worry, after having excluded who responded worry about something.

OR: odds ratio. CI: confidence interval. . P: p value when comparing the

proportions with chi square or Fisher's exact test.

**Table 3:** Variables related to specific stress of pregnancy in the study groups

To assess the strength of association between the variables related to pregnancy-specific stress with PB, taking into account the effect of intervention of covariates that the bivariate analysis and the theoretical context suggested to be related to PB, a multivariate model with logistic regression was constructed. The model identified as variables associated with PB, the variable being very concerned about the care it would have with the new baby (OR 2.58, CI95% 1.21-5.47) and being born by caesarean section (OR 5.59, CI95% 2.63-11.90). On the other hand, worrying about paying for the clothes, food and medical expenses of the baby, the history of PB, multiple pregnancy and diseases during pregnancy lost the statistical significance they had shown in the bivariate analysis (Table 4).

| Covariables | OR * | (CI95%)* | OR** | (CI95%)** | P ** |
|---|---|---|---|---|---|
| Worry about your job and your family's care during pregnancy | 1.6 | 1.01-2.55 | 1.1 | 0.49-2.42 | 0.817 |
| Worrying about paying for the clothes, food and medical expenses of the baby, of course, and a little | 1.55 | 1.00-2.39 | 1.05 | 0.54-2.06 | 0.88 |
| Worry a lot about the care you will have with the new baby as not and much | 1.45 | 0.96-2.22 | 2.58 | 1.21-5.47 | 0.014 |
| Worry about feeling tired and with little energy during your pregnancy as not and a little | 1.44 | 0.94-2.21 | 1.17 | 0.62-2.22 | 0. 621 |
| Antecedent of spontaneous PB | 1.98 | 1.17-3.36 | 2.04 | 0.88-4.71 | 0.095 |
| Diseases in the pregnancy | 1.49 | 1.03-2.17 | 1.36 | 0.74-2.50 | 0.323 |
| Multiple pregnancy | 14.72 | 4.28-60.63 | 2.9 | 0.71-11.83 | 0.137 |
| Caesarean section | 4.93 | 3.26-7.48 | 5.59 | 2.63-11.90 | < 0.001 |

* OR crude of each variable, with preterm birth as outcome.

** OR adjusted with logistic regression by the method of forced introduction with preterm birth as the outcome of each covariate.

CI: Confidence Interval. P: p value obtained by logistic regression.

Setting the model with the Hosmer and Lemeshow test ($x^2 = 3.6$, p= 0.887)

PB: preterm birth

**Table 4:** Multivariate model with preterm birth as variable outcome.

## Discussion

This study shows that of the variables related to the specific stress of pregnancy, being very concerned about the care they will have with the new premature baby was associated with a higher frequency of PB, in addition to the covariate birth by caesarean section [3]. In relation to the above, using the same questionnaire, Lobel et al. [5] in the USA measured the specific stress between 10 and 25 weeks and 25 weeks of pregnancy in 279 women, and showed that the specific stress of pregnancy is a better predictor of outcomes at birth, than the state of anxiety, perceived stress and that the serious life events.

Also, Cole-Lewis et al. in the US, [11] measured the specific stress of pregnancy in the second and third trimesters of pregnancy in 920 young black and Latina women, found that the specific stress of pregnancy in the third trimester was associated with preterm birth, which did not occur with the specific stress of pregnancy in the second trimester. In the two previous studies, [5,12]. the models constructed allowed us to associate the block of the total of the questions related to specific stress of pregnancy with PB, however, in the present investigation it was specifically identified to worry a lot about the care that you will have with the new baby as variable associated with PB. The fact that a mother is concerned about the care she will have with her premature baby can be explained from the perspective of a primary assessment of the threat that the pregnant woman has for not knowing the care of the premature baby, and of a secondary evaluation of not having enough elements to respond before that threat. It is also worth mentioning that although in the multivariate model the association with PB of the economic expenses of the baby's clothes, food and medical expenses disappeared, about 40% of the pregnant women said they worried about the economic expenses, and the average of the economic income monthly was $ 3,350 Mexican pesos, equivalent to 250 US dollars taking into account the exchange rate parity at the time of data collection, which gives an idea of the level of poverty of the mothers studied. In relation to the above, it is also worth mentioning that the aforementioned monthly economic income was close to that declared in Mexico in the 2010 census, by 40% of the 42 million employed persons. Among the limitations of this research are the fact that having interviewed the mothers only once, it would have been desirable to have done it periodically during the pregnancy, also, the design of cases and controls does not allow to prove causality; In favor, the researcher who collected the information was carefully trained so that, when questioning the mothers, information on events occurred before birth was obtained as far as possible and standardized with a certified psychologist until considerable agreement was obtained [12]. Worry about the care that you would have with the new baby was associated with PB, and behaved as a variable independent of the effect of the other covariates that were studied in this investigation.

## Conclusion

The present study allows us to conclude that of the variables related to pregnancy specific stress, a multivariate model showed that mothers of PB worry about not knowing what care they should have for their new baby, which can be used to implement programs of information to mothers during prenatal care.

Declaration of conflicts of interest: The authors declare that for this investigation no material or financial support was received that generates conflicts of interest.

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