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The monthly rhythm of incidence and age at menarche: thirty five years of research. The circa-vacation-study expectancy rhythm of incidence and age at menarche

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ABSTRACT

The hypothesis that the vacation-study-expectancy scholar regime produces most of the monthly rhythm of the age at menarche (AaM) was tested. Studies on monthly menarche incidence (MI) refuted climatic factors as a main factor in this rhythm, and indicated that the main factor of this rhythm is the succession of expectancies of study (Stu-months) or vacation (Vac-months) months within a year. Thus the hypothesis of seasonal circa-annual rhythm should be modified to the circa-[vacation (fiesta)]-[study (non-fiesta)]-expectancies rhythm for the MI and age at menarche annual rhythms. In several countries Vac-months had higher MI than Stu-months. The high MI of Vac-months was followed by a large decrease when girls started their studies and a MI increase occurred as vacations approached. The hypothesis proposes that at the end of vacations and at the beginning of the study period the AaM should be lowest, and then the mean of AaM should increase because of the menarche delay of girls whose menarche was arrested by the initiation of school work. This pattern was found in four independent samples, from Chile, Colombia, USA and Brazil. The probability that this result be due to random fluctuation of means is extraordinarily low ($P<10^{-8}$). I conclude that the influence of the expectancy of vacation and study periods on the monthly rhythm of the age at menarche is a real process that accounts for most of this rhythm.

Key terms: age at menarche, annual rhythm, circa-vacation-study-expectancy rhythm, fiesta expectancy, menarche incidence

INTRODUCTION

In the early 1970s I undertook a longitudinal follow up study on human growth and development. This study was part of an international program coordinated by the International Center for Childhood (UN) whose main office was in Paris. The program included studies in USA, Europe, South America and Africa. Prof. Nathalie Masse, the Director of this Center, said that the monthly rhythm of menarche incidence was probably not due to climatic factors, because in her experience with the circa-annual monthly rhythm of menarche incidence (MI) the winter (Dec-Jan) peak of menarche often seen in the Northern Hemisphere was present as a summer peak in the Southern Hemisphere (Africa). She suggested performing the analysis in Santiago (Chile, Southern Hemisphere) to see whether this summer peak of MI was also present. We found peaks of menarche incidence in December (Dec), January (Jan) and February (Feb) (Patri et al., 1980) and a striking relationship with the month of birth and conception (Valenzuela et al 1991, 1993) showing non-climatic factors acting on this rhythm. By climatic factors is meant photoperiod, temperature, humidity, cloudiness and any other climatic factor. Then we worked in a multinational group with samples from Hungary, Colombia, India and Chile, with a wide hypothetic-deductive research to elucidate the main factors of the menarche rhythm. To refute seasonality our method assumed: 1) the consistent antithetical expectancies that should necessarily be found between Northern and Southern Hemispheres; 2) the marked differences in climatic conditions between equatorial, tropical, temperate, Arctic and Antarctic and polar earth zones; 3) the similarities of MI that should be found in months of the same season; 4) the marked or antithetical differences that should be found in MI of months belonging to antithetical seasons (summer and winter) and the similarities that should be found in months of different seasons with similar climatic conditions (autumn and spring); 5) the similarity of the rhythm that should be found in regions with the same latitude, altitude and geographical conditions. With all these expected situations we refuted conclusively the seasonality of the circa-annual rhythm of MI; for example: 1) marked rhythms were found in samples from tropical or equatorial zones where the rhythm was not expected (Chennai in India and Medellín in Colombia); 2) in all the examined samples strong differences were found among months of the same season or with the same photoperiod and temperature; it was frequent to find a peak of MI followed by a trough of MI in contiguous months (Valenzuela et al., 1996a, 1996b, 1999; Valenzuela 2004, Valenzuela 2006); 3) samples from contiguous regions belonging to different countries show different MI rhythms. One of the most striking differences in the menarche incidence (MI), between Hemispheres was found in Feb, with a peak in Santiago (summer) and a trough in Europe (winter, Valenzuela et al. 1991, 1993, 1996a, 1996b). This could be produced by climatic factors, but this is refuted because in most countries of Europe, Jan and Dec (winter months as Feb) showed a peak, but Feb showed a trough. In Santiago we observed for Dec-Jan-Feb a peak-peak-peak series, in Europe a peak-peak-trough series. This correlated very well with the quality of months being a vacation (Vac) or a study (Stu) month; in Santiago a Vac-Vac-Vac series and in Europe a Vac-Vac-Stu series occurred for Dec-Jan-Feb, respectively. This discovery was realized independently by Prof. Csoknyay in Hungary, Prof. Srikumari in India, Prof. Pineda in Colombia and by our group in Santiago, because in the four countries Stu-months and Vac-months showed lower and higher MI,

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respectively (Valenzuela et al., 1996a, 1996b, 1999). We decided to test the hypothesis that Stu-months and Vac-months implied low and high MI, respectively. With four samples from Chennai (ancient Madras, India), Debrecen (Hungary), Medellín (Colombia) and Santiago (Chile) we found only 5 out of 48 months that disagreed with the hypothesis, thus the agreement was highly significant ($P<10^{-8}$, Valenzuela et al., 1999). We hypothesized that vacations associated with fiesta (or relaxation) expectancy elicited menarche and that study, associated with non-fiesta (or stress) expectancy, delayed (inhibited) menarche. This does not mean only the relationship with the school-vacation-study period, but with the socio-cultural yearly periodicity that involves students, workers, travelers and most human annual activities. This seems to explain the preliminary conclusion of Nakamura et al. (1986) in Japan that there was not a relationship of the secular changes in the monthly rhythm of MI and secondary school periods. They found annual rhythms with peaks in Apr and Aug since 1891 until now, and a third peak in Jan since 1960. They argued that by 1900 around 1% of girls attended secondary school after the age of 12. From our perspective, this is a premature conclusion because there is the possibility that general social vacations used to coincide with primary school vacations, but no data was provided to test this hypothesis. Also, the two described peaks maintained for more than 90 years agree well with social vacation-work periods. We postulated that the "annual expectancy" or a "long term expectancy" of a "climate" of celebration was the "zeitgeber" (http://en.wikipedia.org/wiki/Zeitgeber) "time giver" or "synchronizer" of the MI annual rhythm, and not the seasonal climate (Valenzuela et al., 1999; Valenzuela, 2004). Thus the following test was to examine the days of celebrations (feasts) for the girls in Medellín and Santiago for which we knew the holidays or, more precisely the days of fiesta. Very significant peaks of MI were found for the birthday and fiesta days that were significant for girls, but not for holidays without special significance for them (a revision of specific days is found in Valenzuela, 2004, where the memory bias was also tested and refuted) or in current holidays of the week (Saturday and Sunday), which did not show a peak of menarche (Valenzuela, 2004).Thus we discarded definitively the refuted hypothesis of the circa-annual seasonal monthly MI and worked with the circa-[vacation (fiesta)]-[study (non-fiesta)] expectancies rhythm as the primary cause of the circa-annual menarche rhythm. This hypothesis proposes that the calendar rhythm of general vacation (fiesta) – study (non-fiesta) lived by girls, year by year since their birth (or even prenatally, remember that the hypothesis proposes a general vacation-study rhythm for everybody not only for girls having menarche) generates a circa-annual rhythm of expectancies of fiesta-non-fiesta that leads to increase MI by the expectancy of a fiesta-period and to stop or delay menarche by the expectancy of a non-fiesta period. Vacation months are associated with a high increase of MI and study months with a trough of MI.

With this in mind, the hypothesis of influence of the fiesta-vacation versus non-fiesta-study on the age at menarche was a logical expectancy. Previously, the age at menarche was related to the season (Gueresi, 1997), but since the relationship found was rather for vacation-study periods, the study of MI and age at menarche according to seasons blurs the relationship of MI with Vac-Stu months and hides the true origin of the menarche rhythm. It seems that our refutation of the seasonal factors presented as early as 1991 (Valenzuela et al., 1991, 1993) was not accepted by researchers working in this field. Matchock et al. (2004) insisted on seasonal factors as the cause of the MI rhythm. Their data show several conclusive refutations of seasonal or climatic factors. They found that May and July (one month before and after the summer solstice, respectively, with similar photoperiod and temperature) had a significant trough ($p<0.001$) and peak ($p<0.0001$) of menarche, respectively. Also, they found that Jan and Feb, two winter months, had a significant peak ($p<0.01$) and trough ($p<0.01$), respectively. These facts refute conclusively the climatic or seasonal hypothesis; but they agree perfectly with our Vac-Stu fiesta-non-fiesta hypothesis. If Dec-Jan are months with vacations as well as Jul-Aug, and Feb (or including middle-end Jan) and Jun (or including beginning-middle Jul) is a month of study, as we know, in general, from the USA vacation-study calendar, the results of Matchock et al (2004) fit perfectly our vacation-study hypothesis. To better understand our hypothesis on the circa-vacation-study age at menarche, let us work with the Chilean school rhythm. In Dec, Jan and Feb (Vac-months) higher MI were found, but in Mar (first Stu-month) a fall in the incidence occurs. This lower incidence continues until Jun; it begins to increase until Dec, where a peak is again observed. The expected annual rhythm of the age at menarche is easy to predict from such a rhythm of incidence. In Mar until Jun lower means of menarche age should be observed (menarche refractory to study delay); the monthly mean should increase from Jun to Dec (the delayed menarche during the Stu-months) as the Vac-months approach. This pattern was seen in Santiago (temperate zone S Hemisphere), Medellín (equatorial zone, N. Hemisphere) and Riberão Preto (Brazil, temperate zone, S. Hemisphere) and published previously (Valenzuela 2004, 2006). The present study intends to test formally the hypothesis of the influence of Stu-months and Vac-month on the age at menarche. The expectancy of studies can delay menarche but it cannot suppress it definitively. Soon or later, according to the impressionableness (in face of the expectancy of fiesta or non-fiesta) of each girl, menarche is going to occur. Those girls that should have had menarche in a certain month (due to their natural sexual maturation) and were delayed by studies (stress) are going to have it in the following months at a higher age of menarche.

RATIONALE, DATA METHODS AND STATISTICS

Rationale

After examining data on the monthly MI we found that the monthly incidence rhythm accounted for the relationship of menarche and the condition Stu-month (low incidence) or Vac-month (high incidence). By assuming that the study regime decreases the MI and delays menarche of susceptible girls, we proposed a hypothesis on the monthly rhythm of the age at menarche (Valenzuela, 2006). The hypothesis proposed that the last month(s) of the long vacation period (with a high MI) and the following Stu-months (with a low MI) should present the lowest means of the age at menarche. In the last Vac-months no more delayed girls are present and in the initial Stu-months only refractory girls for the factors that delayed menarche menstruate at the earliest ages. In the following Stu-months the low incidence and mean age of menarche are maintained or grow slowly, but a tendency to increase the mean age at menarche should be seen until a Vac-month, where a higher incidence of menarche should be observed with a high mean of menarche age (induction of delayed menarche). This increase in the menarche age occurs in the initial Vac-months until all the delayed girls have their menarche; at this point a dramatic fall in the age of menarche should be observed, conserving the high MI that is the characteristic of Vac-months. The expected random monthly incidence of menarche was calculated as the quotient between the number of days of each month and 365.25 (Feb = 28.25 days). As pointed out in the Introduction, our studies showed that it was not properly the fiesta period or holidays, but rather the expectancy of fiesta or holidays is the factor that increases the MI. It was evident that the environment or circumstances related to the expectancy of fiesta (relaxation or reward) or non-fiesta (stress or unwanted situation) could impress strongly the neuro-psycho-endocrine system, so as to change the age of circa-vital events such as menarche (Valenzuela et al., 1999; Valenzuela, 2004, 2006). I think that the expectancy of the event, and not necessarily the event itself was the cause of the rhythm, because of the left-biased bell shaped distribution of menarche around the event. This precluded a recruitment distribution where menarche increases its incidence in the previous days (or weeks or months) of the event (Vac-months) and decreases drastically after the event (Valenzuela et al., 1999; Valenzuela, 2004, 2006). We have called the factor of the rhythm fiesta as a preliminary approach. We do not know whether entering school is a stress factor, but I use this term in a colloquial mode, leaving its demonstration for further research. Hard work is necessary to discover the specific neuro-psycho-endocrine factor. It is important to remark that in Chile the two weeks of winter vacation often occurs in July, but it is not a fixed period; it is defined year to year and it may range from the last week of June to the first week of August. Thus, the winter vacation in Chile cannot produce a clear expectancy of fiesta as fixed holidays or vacations can. We found a strong confirmation of this condition examining MI in the Christian celebration of the Holy Week that is variable in the calendar year to year; as expected the Holy Week did not have a menarche peak (not published). The midyear vacations in Medellín (Colombia), Riberão Preto (Brazil) and in USA (mid-Atlantic states, Matchock et al., 2004) are fixed periods of vacation, thus the fiesta-expectancy for the mid-year vacation does really occur.

DATA AND METHODS

Published data of age at menarche from Santiago, Chile (two samples, 1978 and 1990-1), Medellín, Colombia (1990) and Riberão Preto, Brazil (1998) were studied (Tavares et al., 2000, 2004; Valenzuela, 2006). The condition of Vac-month or Stu-month is in these cited articles. The monthly incidence and the mean age at menarche in a calendar month were indicated as over (+) or under (-) the expected incidence or the total mean age, respectively. Months were classified as Vac-month if they had a week or more of vacation days, when it was indicated in the literature or if it was considered as a Vac-month by the authors; otherwise it was considered as a Stu-month. A more recent sample from USA was included (Matchock et al., 2004); however, this study did not present the age at menarche for each month but the result of the analysis clustering months by season.

STATISTICS

The agreement and disagreement with the hypothesis, given in the Rationale, was indicated for each month by (+) and (-), respectively and a sign test was applied to calculate the statistical significance, under the binomial expected probability of 0.5 for (+) and 0.5 for (-) signs. Since the condition of agreement and disagreement may be difficult to evaluate for a reader who does not know the hypothesis, an example is developed. Feb in Santiago is the last summer Vac-month, thus according to the hypothesis it should present a high MI (Vac-month) but a low mean age at menarche because it happens after two months of vacations where all the delayed girls have had their menarche. If this is found in Santiago a + sign is given to Feb; however, Feb in Medellín (Colombia) or Riberão Preto (South Brazil) is the first school month, after the Dec-Jan vacations so it should present a low MI and a low mean age at menarche. In this example the MI is mentioned to orient the reader, but it was tested in previous articles, thus in the present analysis only the expected mean age at menarche was used to assign the agreement or disagreement with the hypothesis.

RESULTS

The agreement and disagreement with the hypothesis is shown in Table 1 for samples from Santiago (1978 and 1990) and in Table 2 for samples from Medellín (1990) and Riberão Preto (1998). In Table 2 a sample from the mid-Atlantic states of USA (Matchock et al., 2004) is included to test the agreement of MI with the sample from Medellín, because the samples from the Northern Hemisphere share a very similar pattern of vacation-study regime and coincide in having the National Day in July (4^{th} for USA, and 20^{th} for Colombia). However, the samples differ completely in the climatic conditions. While in the Mid-Atlantic States of USA there are four clearly demarked seasons, in Medellín, an equatorial city with eight solar seasons, an "eternal" spring occurs. Differences between the samples also agreed with differences in vacation-study condition of months. Dec in Medellín showed the second peak of MI, but it did not show a significant increase in MI in USA; this also agrees with the hypothesis because in Medellín Dec is a full vacation month, but it is a partial vacation month in USA. Also, the mid-year vacation in Medellín includes days of Jun and finishes in Jul (at the 20^{th} Jul National Day), but the midyear vacation in USA begins in Jul and finishes in Aug; we see a shift toward Aug in the USA sample in relation to Medellín. In the comparison of samples from Medellín and USA a significant correlation was found for the MI ($r = 0.6869$; $p = 0.014$).

In Santiago, in 1978 Mar was a Vac-month and in 1990-1 it was a Stu-month; Sep was Stu-month in 1978 and Vac-month in 1990-1. The standard deviation is missing in the Brazilian sample, so the standard error could not be calculated. The standard error is important because the agreement-disagreement with the hypothesis is interpreted between two consecutive months by their significant difference (more than two standard errors) in the MI (previous analyses) or in the mean age at menarche. The Brazilian sample is rather small, so a large variance and standard error are expected in the monthly incidence of and mean age at menarche, this implies that the tendency of the monthly mean of the age at menarche cannot be precisely evaluated as it can in the other samples. In the Chilean and Colombian samples there was a complete

TABLE 1

Incidence, mean age at menarche and agreement or disagreement with the hypothesis of the influence of the vacation-study condition on the age at menarche. Chilean girls from Santiago sampled in 1990-1 and 1978 (Valenzuela et al., 1999; Valenzuela, 2006).

Age at menarche in months															
		Chilean sample 1990-1991							Chilean sample 1978						
MONTH		N	%	IS	MAM	SE	MS	AHY	N	%	IS	MAM	SE	MS	AHY
JAN	V	415	12.9	+	148.5	0.82	-	+	362	13.9	+	150.6	0.85	-	+
FEB	V	497	15.4	+	148.3	0.67	-	+	344	13.2	+	149.6	0.90	-	+
MAR	S	238	7.4	-	149.1	0.94	-	+	223	8.5	+	151.1	1.04	-	+
APR	S	141	4.4	-	150.5	1.24	-	+	160	6.1	-	150.1	1.33	-	+
MAY	S	142	4.4	-	150.8	1.22	-	+	140	5.4	-	147.9	1.34	-	+
JUN	S	184	5.7	-	149.7	1.10	-	+	187	7.2	-	149.9	1.06	-	+
JUL	V	250	7.8	-	151.3	0.88	-	+	163	6.2	-	151.5	1.13	-	+
AUG	S	221	6.9	-	153.6	0.98	+	±	180	6.9	-	152.9	1.13	+	+
SEP	V	283	8.8	+	151.6	0.88	+	+	181	6.9	-	152.6	1.15	+	+*
OCT	S	234	7.3	-	153.8	0.90	+	+	186	7.1	-	153.0	1.15	+	+
NOV	S	224	7.0	-	155.8	0.88	+	+	184	7.0	-	155.0	1.12	+	+
DEC	V	396	12.3	+	155.6	0.71	+	+	302	11.6	+	157.7	0.78	+	+
Total		3225	100		151.4	0.26			2612	100		151.9	0.31		

MONTH = V (vacation), S (Study); N = number; IS = incidence sign: + = over the expected monthly incidence; - under the expected monthly incidence; MAM = mean age at menarche; SE = standard error; MS = MAM sign; + = mean over the total mean; - = mean under the total mean; AHY = agreement (+) or disagreement (-) with the hypothesis. * In 1978 September was not a vacation month.

TABLE 2

Incidence, mean age at menarche and agreement or disagreement with the hypothesis of the influence of the vacation-study condition on the age at menarche. Samples from Medellín (Colombia, Valenzuela et al., 1999) and Riberão Preto (Brazil, Tavares et al., 2004). Monthly incidence of menarche in a USA sample (Matchock et al., 2004).

Age at menarche in months																
		Medellín sample (1990)							USA		Brazilian sample (1998)					
MONTH	VS	N	%	IS	MAM	SE	MS	AHY	N	VS	N	%	IS	MAM*	MS	AHY
JAN	V	334	9.7	+	147.9	0.75	-	+	274	V	45	9.8	+	148.0	-	+
FEB	S	207	6.0	-	146.8	0.97	-	+	160	S	35	7.6	-	144.3	-	+
MAR	S	208	6.1	-	148.1	0.97	-	+	209	S	41	8.9	+	147.0	-	+
APR	S	246	7.2	-	147.8	0.83	-	+	232	S	28	6.1	-	151.0	+	-
MAY	S	229	6.7	-	148.8	0.94	-	+	171	S	40	8.7	+	148.7	-	+
JUN	V	253	7.4	-	152.0	0.96	+	+	256	S	42	9.1	+	150.2	+	+
JUL	V	559	16.3	+	148.7	0.65	-	+	331	V	38	8.3	-	149.4	±	+
AUG	S	188	5.5	-	149.0	1.18	-	+	240	S	39	8.5	+	150.0	+	-
SEP	S	177	5.2	-	149.9	1.04	+	+	193	S	25	5.4	-	147.3	-	+
OCT	S	231	6.7	-	151.3	0.89	+	+	183	S	28	6.1	-	149.1	-	+
NOV	V	322	9.4	+	151.4	0.85	+	+	224	S	33	7.2	-	152.0	+	+
DEC	V	481	14.0	+	152.3	0.65	+	+	223	V	66	14.4	+	152.7	+	+
Total		3435	100		149.7	0.25			2696	460	100			149.4		

Nomenclature as in Table 1. MAM* = mean without standard error.

agreement with the hypothesis (36 months). In the Brazilian sample only two months disagreed with the expected situation. Thus in the total 48 months we found two disagreements, this occurs with probability $P = 4.27 \times 10^{-12}$. As proposed in the Rationale, one of the most relevant expected results of the hypothesis is the fall in the mean age at menarche between the first month of vacations (long vacations), when a great number of girls with delayed menarche had it, and the last month of vacations or the first month of study. If we observe the mean age at menarche (in months) at Dec and February (both months belong almost to the same season) the opportunity for a contrast is optimum. This is an additional refutation of the climatic genesis of the rhythm; among the four samples we have: Chile 1978, Dec = 157.7, Feb = 149.6 (dif = 8.1 months, $P<10^{-7}$); Chile 1990-1, Dec = 155.6, Feb = 148.3 (dif = 7.3, $P<10^{-8}$); Colombia 1990, Dec = 152.3, Feb = 146.8 (dif = 5.5, $P<10^{-6}$); Brazil 1998, Dec = 152.7, Feb = 144.3 (dif = 8.4, the probability cannot be calculated because the standard deviation is not known, but this difference is surely significant, because the standard deviation in all the samples is near 14 months).

In complete agreement with our hypothesis, and in disagreement with the seasonal hypothesis, the USA sample showed a late menarche for girls having it in Dec and an early menarche in girls having it in Feb (Matchock et al., 2004).

DISCUSSION

It is important to remember that this hypothesis was proposed after seeing the distribution of the monthly incidence of menarche (MI). Thus there is no possibility of a circular epistemological procedure when we studied the age at menarche. We confirm that the beginning of studies delays menarche in some girls, who are going to have it some months later when Vac-months approach. This result was observed in the four samples (and in the USA sample, as far as MI and age at menarche in Dec and Feb are concerned); when the vacation period is coming there is an increased number of girls having menarche at older ages. This occurs at midyear in Medellín and Riberão Preto (and it is expected for USA) with fixed vacations in the middle of the school period. The pattern of MI has been also found in India and Hungary (and in USA as described), thus we can conclude that this is a very probable true cultural-biotic relationship. We confirm our proposition that this is not a seasonal circa-annual rhythm, but a circa-[vacation (fiesta)]-[study (non-fiesta)] expectancies rhythm that is a systematic periodicity repeated year after year, caused by socio-cultural events with deep significance for girls. The decay of the age at menarche from 5.5 to 8.4 months between December and February, in the four samples (and in the sample from USA, but without published values) is an extraordinary biotic process; this decay shows that the cultural-expectancy of important events for girls is a factor comparable to deep under nutrition (Leenstra et al., 2005), highly competitive physical training (Vadocz et al., 2002) or near 50 years in the secular trend of menarche age (Nakamura et al., 1986; Vecek et al., 2012; Woronkowicz et al. 2012).

Unfortunately the Brazilian sample is too small to study the influence of the daily MI or for a precise study of differences in the monthly MI (large standard errors), and the two disagreements with the hypothesis could be due to random fluctuations. It is possible that some fiesta periods are not described in the article, as for example in April and around July-August. Also, the USA study (Matchock et al., 2004) did not provide figures for monthly means of menarche with which a fine test of our hypothesis could be done. However, Dec and Feb agree perfectly with our hypothesis as far as the authors informed qualitatively in the article.

These studies uncover important socio-cultural effects on the neuro-psycho-endocrine system. It is probable that boys are also submitted to such fiesta-expectancy influences, for example growth or sexual development could be accelerated in vacations in relation to the study period; we made some observations in the longitudinal follow up study, but these were not formalized or published. Unfortunately, studies are performed in relation to seasons and this does not allow answering this question. Our study provides a solid framework for psycho-somatic, bio-socio-cultural, socio-endocrine and bio-psycho-anthropological studies. We point out one of these important socio-cultural-endocrine interactions. Dec 8 is a very important religious (Catholic) fiesta. Colombia and Chile are mostly Catholic countries in which the 8 Dec is a holiday and highly celebrated. However, while in Colombia Catholic girls receive often the first communion (an important family fiesta) on this day, the Catholic Church discontinued this practice in Chile. In Colombia several days presented significant accumulation of menarche; among them 8 Dec presented the highest significant peak of MI, but in Chile the MI on 8 Dec was not significantly different from any other day of December (Valenzuela, 2004). Again, we emphasize that it is not the first communion that elicits menarche (in the girl that receives it), but the expectancy of a national and familial fiesta that elicits menarche in girls of these families who are in the time of their first menstruation. Our study reveals that living year by year highly affective-emotional cultural rhythms imprints dynamically the brain so as to condition deeply the neuro-psycho-endocrine axis that is compelled to follow these rhythms. Some cultural elements such as religious or national festivities are shown to have more psycho-endocrine influences than previously expected.

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