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Research Article

Fiesta *vs.* Stress Condition the Incidence and the Age at Menarche. Forty Years of Research

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Abstract

Introduction: The annual rhythm of menarche was proposed to be due to climatic annual variations. The discovery that peaks of incidence of menarche were found in the same months in the North and the South Hemispheres made us to think this hypothesis was not correct. Then we proposed that periods of study (stress) and vacation (relaxation, fiesta) were better factors for this rhythm. If this is so, days of fiesta should present more menarches than current days. In the second hypothesis the age at menarche should be modified by the vacation-study rhythm. Thus, I tested two hypotheses: I) This rhythm and the age at menarche are conditioned by climate factors mostly seasonal variations. II) the contrast between expectancy of fiesta (relaxation) and stress is the main factor of the rhythm and the variation on the age at menarche during the year.

Method: The monthly incidence and age at menarche were obtained from samples of girls in Santiago (Chile), Medellín (Colombia), Debrecen (Hungary), Chennai (India) with data collected directly in these countries. A sample from Barrinhas (Riberao Preto, Brazil) was taken from literature. The climatic hypothesis was tested knowing the main climatic parameters by the latitude of these cities. The annual study-vacation rhythm was obtained from the academic calendar at any city and from direct information of our colleagues working in these cities. A correlate between the climatic rhythm and the study-vacation rhythm with the incidence or age at menarche complete the refutation or affirmation of the hypotheses. Also, the expected peaks of menarche at significance fiesta-days or the birthday were studied directly form the calendar of holidays or the cultural information given by our colleagues.

Results: In the five samples taken individually or together there were clear contradictions with the climatic hypothesis. On the contrary the fiesta-stress hypothesis shows a clear correlation with the monthly incidence and the age at menarche. Days of national, religious fiesta or the birthday showed greatly significant peaks of menarche.

Conclusion: Data refute the climatic hypothesis of the annual rhythm of menarche and agree with the fiesta (vacation)-stress (study) hypothesis.

More Information

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Introduction

The circa-annual rhythm of the incidence of menarche was and is studied under the hypothesis of climatic factors. Since the early studies [1] that found peaks of menarche in December-January of the year (winter in Europe) the seasonal hypothesis was mentioned as the only explanation for this rhythm [2]. However, in these studies there were peaks also in the mid-year (summer in Europe). This does not seem a contradiction for the authors. More recently the climatic factor continues to be presented as the main factor [3]. Most of studies are from the North Hemisphere. In our studies (mostly published in local journals), we found the December-January peak occurred systematically in Santiago (Chile), situated in the Southern Hemisphere [4]. This led us to suspect that the climatic factor was wrong or at least was not the main factor of the rhythm. We decided to study the relationship of the month of menarche and the month of birth and we found a consistent and significant correlation [5]. At this moment a colleague from Hungary wrote us and send data that showed inconsistencies with the climatic hypothesis. She commented that they suspected climate was not the main factor and the rhythm vacation-study could play an important role [6]. Since I was working (for other subjects) with colleagues from Medellin (Colombia) and Madras (now Chennai, India), and had data from Santiago (Chile), I decided to unite these data with those from Debrecen (Hungary) and to realize a formal hypothetic-deductive study testing exhaustively both

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hypotheses. This study was already presented [7] but not with the contrast of both hypotheses. This contrast is performed based in a different epistemology [8].

Here I present results that refuted conclusively the climatic hypothesis as the main factor of the circa-annual rhythm of menarche (C-A-RM) and support the hypothesis that the vacation-study periods, national, religious festivities, holidays, with meaning to girls or personally relevant days as birthdays, explain better the C-A-RM. These ideas were largely presented before [8]. Until the middle 90s only the climatic hypothesis was proposed as the main factor [1-3].

Methods

Data of day, month, and year of menarche and day month and year of birth are the basic information. They came from Chile (Santiago) and Brazil (Riberao Preto) in the South Hemisphere; India (Chennai), Hungary (Debrecen) and Colombia (Medellin) in the North Hemisphere. A wide reference presents these data and previous analyses [5-7,9-12]. Girls were instructed to write only sure data, if any doubt they left data empty, this was to avoid the memory bias. Academics surveyed the collection of data performed by academics or graduated students. Girls were students of primary or high school aged 9 to 18 years. A correction program discarded all inconsistent data or clerical errors. Data from girls aged out of the fixed age interval did not enter the analysis. Naturally, most if not all girls remember the year, less girls the month and even less the day at menarche. The analyses estimated the monthly incidence and the age at menarche of girls from the five studied countries. These estimates were compared with the qualitative climate information of latitude (but rigorous correlation with climatic data were performed and not published because they did not give more relevant comparisons). A More detailed methodology is in previous articles. The condition of days of fiesta were taken from the calendar (holidays) and from the direct information of our colleagues working in these cities. In previous articles there were a different of relevant celebrations for girls and not-relevant celebrations. A detailed analysis of cultural significance (religious, national, scholar, etc.) is out of the scope of these studies. The birthday was the date of birth. The coincidence with menarche is direct from the date at menarche. The influence of a special day is measured by the number of menarches at this day. Statistics in this case is direct from data of tables and is indicated as results are presented. Under the mentioned epistemology [8] a probability of occurrence of a difference is calculated according to data. Present statistics performs general analyses; in this new epistemology the most important contribution comes from the analysis of the critical structure of data given the proposed hypothesis.

Rationale and hypotheses testing

We test the hypotheses: I) climate II) the expectancy of fiesta or stress: is the main factor for the annual menarche rhythm. I) The C-A-RM is produced or conditioned by the circa-annual climatic rhythm that included variation in daily, monthly or yearly light or brightness, temperature and humidity. Data on these variables were studied but at last not included in this article because the Latitude of the city is sufficient information on them (general knowledge). Latitude is given in Results. The hypothesis of a positive correlation between the incidence and age at menarche with these climatic variables was tested; in the new epistemology the dynamic structure of data during a year is critical. For example, due to logic, month of the same season must have more similarities than month of different extreme seasons (winter – summer); months of spring must behave as months of autumn in template and artic climates. Besides that what happens in a month influences the other months, specially the contiguous ones II) The C-A-RM is produced or conditioned by the circa-annual vacation-study rhythm: vacation periods associated positively with increased incidence of menarche and study periods with decreased incidence of menarche. Days of national, religious celebrations relevant for girls or the birthday associate to higher incidence of menarche and current days will show incidences not significant different from the mean. The convention to classify the month of vacation or study was more than a week of vacation or festivities was a vacation month. Within this hypothesis the annual dynamic behavior of the menarche incidence in a month is critical for the whole behavior in the year (see Results). The expected random incidence (if no factor is involved in the incidence of menarche) of menarche is 8.5% for month with 31 days, 7,7% for February and 8,2% for months with 30 days.

Results

Table 1 shows the monthly distribution of incidence (%) and mean age at menarche (in months) in Santiago (Chile), Lat 33°27’ S, template climate, marked seasons, Medellín (Colombia), 6°15’ N, equatorial homogeneous climate, 8 seasons, eternal spring, and Barrinhas (Riberao Preto, Brazil), Lat 21°11’ S, tropical-template climate, marked seasons [1], and monthly incidence of menarche in Chennai (India) Lat 13°5’ N tropical-warm climate, and Debrecen (Hungary), Lat 47°32’ N cold-template weather, marked seasons [1,3,5-9]. The column VS indicates de condition of the vacation or study of the respective month.

Testing the climatic hypothesis

Incidence of menarche: If warm weather elicits menarche the expected situation in the South Hemisphere (Santiago and Barinhas) is the highest incidence in summer (December, January, February and March) the lowest incidence in Winter (May, June, July, August) a slow decrease in incidence from March to May and slow increase from May to August. The North Hemisphere (Chennai, Debrecen) should show an antithetical behavior, and Medellin that is an equatorial city (with 8 seasons) should show and homogeneous menarche incidence along the year. This is not the observed rhythm in the four samples.

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Table 1: Incidence and age at menarche in five samples, age in months.

	Santiago			Medellin			Brazil			India		Hungary	
Month	Inc %	MAM	VS	Inc %	MAM	VS	Inc %	MAM	VS	Inc %	VS	Inc %	VS
January	12.9	148.5	V	9.7	147.9	V	9.8	148.0	V	7.8	S	15.0	V
February	15.4	148.3	V	6.0	146.8	S	7.6	144.3	S	4.5	S	6.4	S
March	7.4	149.1	S	6.1	148.1	S	8.9	147.0	S	6.1	S	6.4	S
April	4.4	150.5	S	7.2	147.8	S	6.1	151.0	S	10.7	V	7.1	S
May	4.4	150.8	S	6.7	148.8	S	8.7	148.7	S	13.7	V	6.4	S
June	5.7	149.7	S	7.4	152.2	V	9.1	150.2	S	10.6	V	8.3	V
July	7.8	151.3	S	16.3	148.7	V	8.3	149.4	V	6.3	S	10.1	V
August	6.9	153.6	S	5.5	149.0	S	8.5	150.0	S	7.7	S	12.0	V
September	8.8	151.6	V	5.2	149.9	S	5.4	147.3	S	8.1	S	7.5	S
October	7.3	153.8	S	6.7	151.3	S	6.1	149.1	S	9.2	V	6.1	S
November	7.0	155.8	S	9.4	151.4	V	7.2	152.0	S	7.0	S	6.5	S
December	12.3	155.6	V	14.0	152.3	V	14.4	152.7	V	8.3	V	8.2	V
Total N		3225			3435			460		3454		2356	
Total mean		151.4			149.7			149.4					

Nomenclature. Inc = Incidence; MAM = Mean age at Menarche; V = Vacation; S = Study

While there is an apparent concordance in Santiago and Riberao Preto, some results refute categorically the hypothesis (analysis of the dynamic structure of data): a sharp significant decay in the incidence from February (15.4) to March (7.4) and a sharp increase from November (7.0) to December (12.3) in Santiago; the same occurs in Riberao Preto but from January (9.8) to February (7.6) and November (7.2) to December (14.4). Statistics of this figures are unnecessary. A t test (numbers allow to deal with it as a z test) between February (15.4, n = 497) and March (7.4, n = 239) in Santiago yields t = 4.68, $p < 0.00003$. A correction with all the possible pairs of months (66) yields probability p = 0.00198 (the high significance remains). But this is an erroneous correction because February in Santiago has highly significant comparisons with all the months excepting December and January. Given the total number, any difference in incidence of more than 4% is significant in Santiago, Medellín, India and Debrecen. Moreover, these contradictory months are contiguous, so under the climatic hypothesis they must have a similar incidence (conclusively refuted). Debrecen show the maximal incidence in January (refutes the hypothesis) and high incidences in July and August (agree the hypothesis). Chennai is even more contradictory with the hypothesis because peaks of the incidence of menarche were found in April, May and June (mostly autumn month). All these countries show a statistically significant decay in the menarche incidence when girls change from a vacation to a study month. This is the most critical, relevant and conclusive result. I do not refer more to the Brazil sample because of it small number of girls. If cold weather elicits menarche the climatic hypothesis is antithetically refuted. Medellín is perhaps the most contradictory with the climatic hypothesis under which a homogeneous distribution of incidence and age at menarche should occur along the year. However, Medellín shows four larger incidences in November (9.4), December (14.0), January (9.7) that is the end and beginning of the year and July (16.3) at the middle year. The incidence of July (the highest in the study) is sufficient to refute the climatic hypothesis of the menarche rhythm as the main factor.

Age at menarche: If we assume that older ages at menarche are found on summer and younger ones at winter, Table 1 refutes conclusively the climatic hypothesis. The three samples that allow this comparison are Santiago, Medellin and Brazil that show the highest ages at menarche in November and December and the lowest ones at January and February, contiguous months that belong to almost the same season; thus, they should show similar ages at menarche. The decay of the age at menarche between December and February is remarkable: Santiago 7.3 months; Medellin 5.5 months; Brazil 8.4 months; the differences are largely significant in Santiago and Medellin (Brazil cannot be tested).

Testing the fiesta-stress hypothesis

Vacation-study hypothesis, incidence: In Table 1, in general all the months of vacation (V) show larger incidence of menarche regardless the Hemisphere where the city is found. Some exceptions are due to the fact that this month precedes or follows a month with a great incidence of menarche (accurate tests are in previous articles). The study months show small incidence with a few exceptions due to the same situation they are beside a vacation month and some overlapping occurs. No refutable situation to the hypothesis occurred. This will clearer when studying the age at menarche. I mention the sign test (binomial distribution) we performed to test the hypothesis: vacation months associated to higher menarche incidence and study months to lower incidences. In Santiago all the vacation months had higher incidences and study month had lower incidences; this occurs at random with probability $p = (½)^{12} = 0.000244$. In Medellin 11 of the 12 months coincide with the hypothesis, p = 0.00317. In Chennai 10 of 12 months coincide with the hypothesis ($p < 0.02$). In Debrecen 11 of 12 coincide with hypothesis ($p < 0.00317$). These tests are from the current statistics however, they do not test the structure of data given the hypothesis of fiesta-stress. For example, the expected homogeneity of incidence within a season, the strong difference of data coming from different seasons or contiguous months and the equality of data from spring and autumn. The reader can complete the analysis of these data.

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Vacation-study hypothesis, age at menarche: It is not possible to test the hypothesis (fiesta-stress, in this case vacation-study) because if fiesta increase and stress decrease the occurrence of menarche the precedent (because this is a circular process) and the following months are influenced in their age at menarche. We must consider this condition and propose a complete model for the year.

Let us begin with Santiago. We assume that January and February are vacation months, girls are relaxed and have menarche at the youngest ages (this is true in Table 1). In March the school study begins and produces a strong decay in the incidence of menarches, leaving girls whose menarches are arrested to have menarches at older ages in the following months, and this occurs until November with few exceptions of small sizes probably due to statistical variation. There is a great deal of girls with their menarche arrested waiting for a time of relaxation from the study. This occurs at the end of November and December where all the girls whose menarche were arrested have their menarches at the oldest ages (155.8 and 155.6 months respectively). In Medellin the situation varies because they have a middle year vacation from 16th June to 6th July followed by the Independence Day at 20th July; the end of the year vacation occurs from 6th December to 27th January (some days vary from year to year). Similar to Santiago January has a small age at menarche and incidence over the mean for a month with 31 days (8,5%). Remember here the decay in the menarche incidence is from January (vacation) to February (study). These ages are maintained in the following months (around 148 months) of study until June, a mixed month vacation-study with an increase of the age at menarche (152,2 months), perhaps due to the menarche elicited in girls with arrested menarches. Then July which is also a mixed month, but includes the maximal national festivities (Independence 20th July) shows the maximal incidence and a decay in the age at menarche in relation to June. After July the age at menarche increases steadily until its maximal values in November and December where all the girls whose menarche is retarded have their menarche at older ages. After December as described there is a big decay in the age at menarche. Unfortunately, Brazil that offers similar results (remarkable the decay in the age at menarche between November- December and January-February) due to the small sample cannot allow a conclusive analysis.

The fiesta-stress expectancy hypothesis and the day at menarche: If the fiesta-stress hypothesis is true, the expectancy of fiesta or relaxation must operate in festivities relevant for girls. We can test this hypothesis in Santiago and Medellín where the day at menarche was registered.

Santiago: Each month has its own mean of menarches in one day. Thus, the significance was calculated according to this mean and standard deviation (SD) [8]. The most exigent test shows significant peaks of menarche at: 1st January, New Year (mean = 8.48) 33M(menarches); 14th February, Lovers' Day (mean = 10.48) 43M; 28th 18 M (without relationship with any known festivity); 18th September, Independence Day (mean = 5.73) 23M. December (mean = 10.74) has several significant days in relation to Christmas: 22nd 22M; 24th 30M; 25th 23M; without relation with Christmas but with New Year 31st 26M. The coincidence with the birthday was greatly significant. In Santiago (mean menarches a day = 10.36M) the birthday showed 49M but significant days with higher incidence of menarche were observed from 3 days before and 3 days after the birthday.

Medellín: With the same exigent criterion used in Santiago only July and December showed significant days with higher incidence of menarche. July (mean = 10.74): 20th Independence Day 22M. December: 8th Immaculate Conception of Virgin Mary (Catholic festivity) 28M; 16th unknown festivity 23M; in relation to Christmas 22nd 18M, 24th 19M; after Christmas 28th 22M (unknown celebration) and previous to New Year 31st 19M. With a mean incidence of menarche in a day equal to 9.91 the birthday showed a significant higher incidence of menarche 36M and not all days from 3 days before and 3 days after birthday showed a significant higher frequency of menarche [8].

Discussion

It is evident that the climate hypothesis as a main factor cannot account for the yearly menarche rhythm of the incidence and age at menarche and that the fiesta-stress hypothesis account not only for these rhythms but for the tendencies of the incidence and age at menarche along the year. That the days of celebrations significant for girls show more menarches than current days is out of doubt, as far as these data show. However, these results and analyses have not been incorporated in current studies. I did not find references to vacation-study factor as the origin of this circa-annual rhythm. All the studies of age or incidence of menarche should consider at least the vacation-study periods so as to correct the results by these factors. The decay of the age at menarche by more than 5 months between November-December to January-February, in countries or cities where there is in these months the end-beginning of the study period is notable. It is important to have in mind that it is not the holiday, fiesta or stress the factor that influence but the expectancy of relaxation or stress the main factor.

The analyses have some restrictions. The Brazil sample does not provide standard deviations so standard errors cannot be calculated; the analysis is greatly restricted. In literature the most important bias of these studies is the bias of memory. In our epistemology biases are physical or mental processes, so they are hypothesis that can be tested and very often discarded with the same data. We decreased the probability of this bias by demanding girls to write date of menarche if and only if they were sure of the date. One of these biases is the assignation to the fiesta day or birthday some menarches occurred before or after these days. The

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consequence of this bias is the increased number of menarches in the fiesta or birthday and the decreased number in days before or after this day, generating a W shaped sequence, with shorter lateral branches. We have never found this distribution, on the contrary, all the distributions around these singular days are bell shaped with deviation to the left. These distributions are typical of processes of recruitment around a special event. The second bias is the bias of forgetting the day of menarche; the suspected (but not necessarily true) bias is that girls who forgot the exact day may belong to the population that did not have menarche to a particular singular day (fiesta or birthday). This bias can be studied by taking the sub-sample that remember year-month-day at menarche and analyzing it with its total number (the least restricted expectancy of the total number). Then we take total number of girls that remember the year and the month but not the days and analyze this subsample with this total (the medium restriction of total number) and finally the analysis can be performed with those girls that remember only the year at menarche (the complete restricted total number) and proceed to calculate the significant days of menarche incidence. Here I applied the least complete restriction to the total number of girls. Thus, significance days of menarche incidence are sure that they have a higher incidence in relation to the other days of the year. In general bias are mentioned to indicate caution to interpret data and invalidate analyses. I think this is not correct from a serious epistemology. Biases are as hypotheses as those that are being tested and it is necessary to demonstrate them before discarding the analyses.

Results do not exclude any participation of climate factors in conditioning the incidence and age at menarche; they may produce some minor effects but they are under the power of resolution of these analyses or they are included within the fiesta-stress rhythms. It is known that a great deal of fiesta specially the religious celebrations have been programmed in relation to sun or moon annual cycles. However, these days are variable in the calendar and they difficulty can produce a systematic effect. This study is tightly attached to data and the reader may realize that interpretations are difficult. I have presented this hypothesis in several countries, congresses and journals and I have not received alternative explanations. Why girls have more menarches in relaxed periods than in stresses periods may lead to several neuropsychic explanation but this is out of these studies. Menses also receive these influences. Of course, there may be other hidden factor in these periods; I leave the subject open to researchers. In one presentation, I talked about that fiesta, holidays or the birthday must be relevant to the girls to elicit menarches. I tested one month in Chile that has a holiday relevant and another irrelevant for girls. The month May have the 1st day that is the workers' day (irrelevant for girls) and 21st a national glory of the Chilean navy with great celebrations at schools. In this battle the Chilean captain of a wood ship jumped abord a battle ship. He died on the deck of the ship. This captain was bald. A psychoanalyst gave the interpretation that a bald persons may represent a phallic object and this may influence menarche. I feel this is a too farfetched hypothesis.

These results show a great influence of cultural events included those religious events with emotional meaning on the neuro-endocrine system. These events impress the neuropsychic system more than climatic events, but they are inserted in the seasonal rhythm, so studies of the menarche rhythm should discard first these factors.

Conclusion

The hypothesis testing study of the contrast climate vs fiesta-stress factors of the annua rhythm of menarche has refuted the participation of climate factors and affirmed the participation of fiesta-stress factors as main factors of this circannual rhythm.

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