Research Article

Is Menstrual Bleeding A Problem For Students?

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Received date: *26-03-2018;* ***Accepted date:*** *29-03-2018;* ***Published date:*** *02-04-2018*

Abstract

Objectives: To determine the length and intensity of monthly bleeding using the characteristics of the pictorial blood loss assessment chart (PBAC) in a cohort of school girls and university students aged under 26 years and to determine the percentage of this cohort with a PBAC score >100.

Design: Evidence obtained from several timed series with or without the intervention. Prospective observational study

Design Classification: Ii-3

Setting: Secondary school and university centre

Patients: 82 secondary school and university students aged 12-25 years.

Interventions: They completed a PBAC prospectively within their last menstruation

Methods: The sample was divided into three age groups (12-16, 17-20, 21-25 years). The link between variables was determined using the ^{2} test, Pearson's linear correlation coefficient, binary or multinomial logistic regression, the Mann-Whitney U test and the Kruskal-Wallis H test (significance level 5%).

Measurements and main results: Overall, an average of 19.72% menstrual hygiene products (MHP) were discarded per menstruation (95% CI: 17.18-22.26). The sanitary pads and tampons discarded were of low or medium capacity. The average of PBAC score was 171.01 (95% CI: 142.39-199.64) and 68% of the sample had a PBAC score >100.

Conclusions: The PBAC score did not show any relation to age or length of cycle, although it was linked to the number of bleeding days. The PBAC could facilitate identification of women at risk from menstrual bleeding disorders and enable appropriate measures to be taken in primary care womens' health clinics.

Key words

Adolescents female; menstruation; menorrhagia; menstrual hygiene product

Introduction

Nowadays, young women and their parents may find it difficult to determine whether menstruation follows a normal pattern and doctors sometimes lack information on the issue. Different authors have sought to define standardized parameters [1]. Heavy Menstrual Bleeding (HMB) for this age group could be between 33% and 56% [2,3]. In the case of university students the figure would appear to fluctuate between 22% and 59% [4-7]. However, an easy way to quantify menstrual bleeding amongst teenagers and young women has still not been found. Higham et al. [8], using one specific brand of menstrual hygiene products (MHP), proposed a semi-objective

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DOI:

10.4103/2278-960X.194514

method called Pictorial Blood Loss Assessment Chart (PBAC), which gave a score (PBAC score). The sensitivity and specificity of the PBAC score has been studied in healthy women [9,10] and it has been considered a useful tool for the screening of menstrual bleeding problems. Alternative PBAC models have been designed, based, for example, on the use of sanitary pads with superabsorbent polymers, with two absorption capacities, i.e. higher and lower [11]. The authors also reached the conclusion that it was a useful instrument for the predictive diagnosis of HMB in clinical practice. In Spain, a study was performed that only took into account the number of sanitary pads and tampons used, regardless of their absorption capacity, and the conclusion reached was that this method could also be used to monitor the evolution of the volume of menstrual bleeding. Another study, focused on menstrual bleeding in adolescents, proposed a reduction from 20 to 10 points in the score assigned to totally saturated sanitary pads [12].

We consider our study to be relevant from a clinical perspective as it helped us to detect HMB problems and even to standardize parameters which could serve to approach the diagnosis of such problems, despite the subjective nature of blood loss volume calculation and even without determining haematic parameters in a healthy population. The general aim of the present study is to determine the standard length of the menstrual cycle in adolescents and young women, the length and intensity of menstrual bleeding using PBAC score and its fluctuations depending on the age group. With that aim in mind we studied a cohort of healthy schoolgirls and university students under 26 years of age (average age on completion of higher education in Spain), resident in southern Spain. As a specific aim, we have sought to determine whether there is an age group with a PBAC score of >100 (equivalent to 80cc of menstrual blood loss) [13] which is therefore at risk of HMB.

Subjects and Methods

An observational comparative case study was carried out between the months of February and May 2015 in a population of secondary school pupils (public sector institution) and university students (private sector institution) resident in two cities in the south of Spain.

An accidental, non-probability sampling technique was used, whereby all the pupils and students at both institutions were invited to participate in the study, having first obtained the authorisation of the Directors of each institution. The inclusion criteria were as follows: to be aged between 12 and 25 years, to have experienced menarche, not to be a user of hormonal contraceptives, not be receiving hormone treatment and not be suffering from any gynaecological disease. The exclusion criteria were as follows: use of hormonal contraception or having been a user in the previous three months; postpartum women; recent miscarriage or abortion; lactating mothers. The minimum sample size for a potential total population of 556 students, taken from the census of both institutions, was determined using the formula of sample size for finite populations $n= [N^*Z(1-\alpha)2^*p^*q]/[d2^*(N-1)+ Z(1-\alpha)2^*p^*q]$ [14]. Considering a maximum error of 5%, the minimum sample size for this study was established at 78 students.

The criteria to participate in the study were fulfilled by 270 women (69 secondary school pupils and 201 university students). The sample was divided into 3 age groups, reflecting three stages of education in Spain, namely compulsory secondary education, up to the age of 16, non-compulsory education or transitional period from 16 to 20, and higher education (undergraduate and postgraduate levels) up to the age of 25. The data presented here are based on the analysis of 82 PBACs, corresponding to 11 schoolgirls and 71 university students, all of Caucasian origin. After selection, the participants filled out a coded form with their basic socio-demographic data and their menstrual history. They received a modified PBAC to enable them to describe the capacity and degree of saturation of the MHP they discarded daily. Instructions were given to enable them to fill out the chart which they did during the menstruation following their inclusion in the study, once it had been established that they fulfilled the criteria and they had accepted participation. In the chart, questions covered length of menstrual cycle and bleeding. In the PBAC itself, participants noted the number of MHPs discarded daily, the level of saturation and the absorption capacity of such products, including both sanitary pads and tampons.

The Study Protocol was approved on the 28th of May 2014 by the Commission of Ethics of San Cecilio University Hospital (Granada, Spain). Everyone taking part signed an informed consent.

Using SPSS®20.0 (SPSS Inc., Chicago, IL, USA) the link between variables was determined using the χ^2 test, Pearson's linear correlation coefficient, binary or multinomial logistic regression, the Mann-Whitney U test and the Kruskal-Wallis H test (significance level 5%) where appropiate. A p value of less than 0.05 was considered significant.

Results

The study was completed by a total of 82 women (Figure 1), out of a total of 270 who accepted participation. 146 participants were lost as they failed to register the PBAC in the established period or subsequently dropped out of the study, 35 did not fill in the PBAC correctly, and 7 left the study when it was found that they did not fulfill the inclusion criteria, after they had filled in the questionnaire. The participation rate expressed in percentage terms was thus 30,37%.

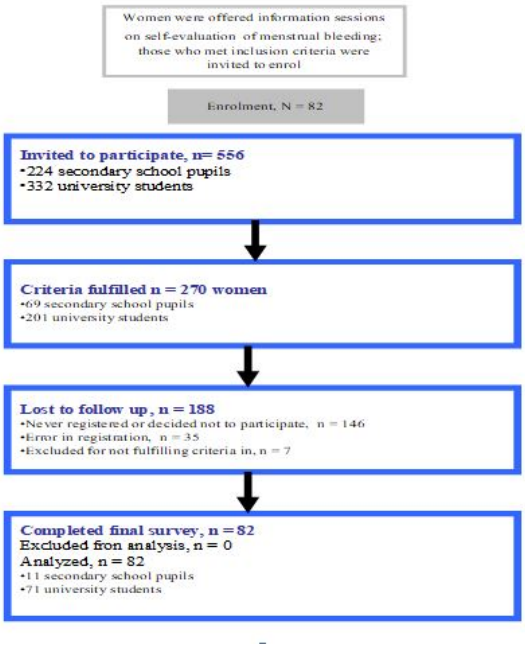

Figure 1: Selection process for study participants

The average age of the participants was 20.46 years (SD 3.01, 95% CI 19.80-21.13): 9 (11%) aged 12-16 (Group 1); 23 (28%) aged 17-20 (Group 2) and 50 (61%) aged 21-25 (Group 3). At the time of recruitment, 80 (98%) considered themselves healthy and two suffered from thyroid dysfunction; 47 had regular cycles (25-32 days), 6 had more than one period per month (less than 25 days), 12 had less than 9 per year (> 33 days) and 16 considered their cycle to be irregular. Seventy-six percent of the participants stated that menstrual bleeding lasted 3-5 days.

A statistically significant link was found between length of cycle and age (p=.018) and multinomial logistic regression was used to quantify its strength of the relationship between
these two variables, as shown in (Table 1).

Length of menstrual cycle [a]	Age [b]	OR
< 25 days	12 – 16 years	≈ 0
	17 – 20 years	0.5
> 33 days	12 – 16 years	≈ 0
	17 – 20 years	0.227
Irregular	12 – 16 years	4.5
	17 – 20 years	5.625
[a] Reference Category: 25 – 32 days		
[b] Reference Category: 21 – 25 years		

Table 1: Length of menstrual cycle

The average length of periods in the sample as a whole was 5.4 days (SD 1.24, 95% CI 5.13-5.67) (Table 2) shows the length of bleeding according to age. Overall, during the whole menstruation, the average number of MHP discarded was 19.72 (SD 11.57, 95% CI 17.18-22.26), and 3.60/day (SD 1.72, 95% CI 3.22-3.98) (p=.05). Saturation of the products used was as follows: 6.95 completely saturated pads (SD 5.05, 95% CI 5.30-7.88), 5.91 moderately soiled pads (SD 3.64, 95% CI 5.02-6.80) and 3.95 lightly stained (SD 2.62, 95% CI 3.31-4.60). In the case of tampons, the results were as follows: 7.89 completely saturated (SD 4.54; 95% CI 6.33-9.44), 5.47 moderately soiled (SD 3.46, 95% CI 4.22-6.72) and 3.57 lightly stained (SD 2.10, 95% CI 2.78-4.35).

Characteristic	Gr. 1 (12-16 years)	Gr.2 (17-20 years)	Gr. 3 (21-25 years	
	n=9	n=23	n=50	
	Mean ± SD [b] (95% CI) [c]	Mean ± SD [b] (95% CI) [c]	Mean ± SD [b] (95% CI) [c]	p-value[a]
				Gr. 1 *vs.* 2
				Gr. 1 *vs.* 3
				Gr. 2 *vs.*3
Length of period (days)	5.89 ± 1.27 (4.91-6.86)	5.30 ± 1.40 (4.70-5.91)	5.36 ± 1.16 (5.03-5.69)	NS
				NS
				NS
Use of tampons, pads, or both during period	13.78 ± 5.36 (9.66-17.90)	20.65 ± 10.56 (16.08-25.22)	20.36 ± 12.61 (16.78-23.94)	0.028
				NS
				NS

Use of tampons, pads, or both/day	2.42 ± 0.95 (1.70-3.15)	3.84 ± 1.71 (3.11-4.58)	3.70 ± 1.77 (3.19-4.20)	0.006
				0.026
				NS
Pads/tampons used on first day of cycle	2.00 ± 0.71 (1.46-2.54)	4.00 ± 2.65 (2.86-5.14)	3.76 ± 2.30 (3.11-4.41)	0.022
				0.005
				NS
Pads/tampons used on second day of cycle	2.67 ± 1.00 (1.90-3.44)	4.91 ± 2.33 (3.90-5.92)	4.76 ± 2.36 (4.09-5.43)	0.005
				0.001
				NS
Pads/tampons used on third day of cycle	2.89 ± 0.78 (2.29-3.49)	4.52 ± 2.09 (3.62-5.52)	4.38 ± 2.49 (3.67-5.09)	0.007
				0.033
				NS
Pads/tampons used on fourth day of cycle	2.89 ± 1.27 (1.91-3.86)	3.84 ± 1.71 (3.02-4.67)	3.63 ± 2.60 (2.88-4.38)	NS
				NS
				NS
PBAC score [d]	115.56 ± 65.81	173.96 ± 130.81	179.64 ± 137.93	NS
	(64.97-166.14)	(117.39-230.52)	(140.44-218.84)	NS
				NS

[a] p-value obtained applying Mann-Whitney's U Test

[b] SD: Standard Deviation

[c] 95% CI: Confidence Interval of 95%

[d] PBAC score according to Higham's criteria

[e] Mann-Whitney's U Test not carried out due to lack of cases in Group 1

NS: Not Significant (p>0.05)

Table 2a : Use of MHP and PBAC score

Characteristic	**Gr.1 (12-16 years) n=9**	**Gr.2 (17-20 years) n=23**	**Gr.3 (21-25 years) n=50**	
				p-value [a]
	Mean ± SD [b] **(95% CI)** [c]	**Mean ± SD** [b] **(95% CI)** [c]	**Mean ± SD** [b] **(95% CI)** [c]	Gr. 1 *vs.* 2
				Gr. 1 *vs.* 3
				Gr. 2 *vs.* 3
Completely saturated pads	4.50 ± 2.83 (2.14-6.86)	6.65 ± 5.44 (3.85-9.45)	7.03 ± 5.23 (5.26-8.80)	NS
				NS
				NS
Moderately soiled pads	6.44 ± 3.43 (3.81-9.08)	6.74 ± 3.96 (4.83-8.64)	5.38 ± 3.53 (4.24-6.53)	NS
				NS
				NS
Lightly stained pads	3.75 ± 2.44 (1.71-5.79)	4.16 ± 2.57 (2.92-5.39)	3.90 ± 2.73 (3.01-4.78)	NS
				NS

				NS
Completely saturated tampons	0	5.64 ± 3.90 (3.39-7.89)	9.38 ± 4.39 (7.38-11.38)	[e]
				[e]
				0.015
Moderately soiled tampons	0	3.55 ± 2.07 (2.16-4.93)	6.48 ± 3.66 (4.81-8.14)	[e]
				[e]
				0.018
Lightly stained tampons	0	3.36 ± 2.38 (1.77-4.96)	3.68 ± 1.97 (2.73-4.64)	[e]
				[e]
				NS

a p-value obtained applying Mann-Whitney's U Test

b SD: Standard Deviation

c 95% CI: Confidence Interval of 95%

d PBAC score according to Higham's criteria

e Mann-Whitney's U Test not carried out due to lack of cases in Group 1

NS: Not Significant (p>0.05)

Table 2b: Use of MHP and PBAC score

Nº of days bleeding	**PBAC score**	
	Mean ± SD [a] (95% CI) [b]	**OR**
1-4 days (n=19)	86.05 ± 48.04 (62.90-109.2)	[c]
5-6 days (n=42)	167.17 ± 104.18 (134.70-199.63)	1.017
≥ 7 days (n=21)	255.57 ± 173.26 (176.70-334.44)	1.022
p-value = .000 obtained applying Kruskal-Wallis test		
[a] SD: Standard Deviation		
[b] 95% CI: Confidence Interval of 95%		
[c] Reference Category: 1-4 days		

Table 3: PBAC score and length of menstruation

The completely saturated or moderately soiled pads were products with low saturation capacity (p=.006 and p=.015) whereas the medium capacity pads were discarded moderately soiled or lightly stained (p=.004 and p=.008). Over the whole sample the completely saturated tampons were products with a medium (p=.048) or high capacity (p=.004) which were also moderately soiled when discarded (p=.041). Group 2 discarded more low and medium capacity pads that were moderately soiled (p=.018 and p=.007). Those of medium absorption capacity were also only lightly stained (p=.031). The completely saturated tampons were products of medium capacity p=.044). Group 3 discarded more moderately soiled low and medium capacity pads (p=.017 and p=.002) or pads that were only lightly stained (p=.037). High capacity tampons tended to be completely saturated when discarded (p=.018). In all three age groups overall preference was for medium absorption capacity pads (p=025).

The mean PBAC score was 171.01 (SD 130.28, 95% CI 142.39-199.64) or 129.99 (SD 87.98, 95% 102.66-141.32) if 20 or 10 points were assigned to the completely saturated pads discarded, respectively (Table 2) [12]. (Table 3) shows the relation between PBAC score and length of menstruation (p=.000). 20% of participants obtained a PBAC score >100 (22% of Group 1, 21% of Group 2 and 18% of Group 3).

The clot expulsion rate, without specification of clot size, was as follows: Group 1 (0 cases), Group 2 (6 cases), Group 3 (25 cases) (p=0.007). The PBAC score was higher in the group of women who stated that they experienced clot expulsion.

Discussion

The age limits in our study reflect the average age of menarche and the average age at which higher education is completed. Similarly, the division of the population analyzed into three differentiated age groups reflects three stages within the current education system in Spain.

The study shows that an association has been found between cycle length and the age of the participants (p=.018). Although the most frequent cycles in all three groups lasted 25-32 days, it was observed that the

women in Groups 1 and 2 were respectively 4.5 and 5.6 times more likely to have an irregular cycle deviating from the 25-32 days prevalent in Group 3. Group 3 subjects also had a higher risk of their cycle lasting < 25 days or > 33 days in comparison to the 25-32 day cycle. These findings are similar to figures in the literature [15].

In the present study, period length did not present significant differences for the three age groups and they were within the limits reflected in the literature consulted [1]. We have not found research relating the use of MHP with age, although some overall studies have been conducted amongst university students [16-18]. In our study, significant differences were observed between the use of MHP amongst the youngest participants, who used fewer products than the following age group (p=.028). The number of MHP used daily was also significant, with the youngest group once again using fewer than the other groups (p=.006 and p=.026). The number of pads that were completely saturated, moderately soiled or only lightly stained on disposal was similar for all three age groups.

The youngest age group did not use tampons and in the other two age groups there were differences between the completely saturated and moderately soiled tampons in favour of the 17-20 year olds (p=.015 and p=.018).

The link between the use of MHP according to the level of saturation and how they were reflected in the PBAC at the time they were changed was also studied. It was observed that, when discarded, the low capacity pads were completely saturated or moderately soiled (p=.006 and p=.015) and medium capacity pads were moderately soiled or lightly stained (p=.000 and p=.008). In order to determine how this may affect the PBAC score, both aspects were studied. No significant differences between the three groups were observed with regard to pads classified as low or high capacity. However, differences were observed with the medium capacity pads (p=.025) which were used less by Group 1 (average of 4.86) and more by groups 2 and 3. We have not found other studies which correlate age with the use or degree of saturation of MHP. With respect to low capacity pads, both the subjects in Group 2 and those in Group 3 tended to change them when they were moderately soiled (p=.018 and p=.007), which would indicate that low tolerance to saturation –which we know exists– would increase the use of these products. In both groups a link was observed between low and medium capacity pads, disposed of when moderately soiled. There was also a link observed between medium capacity pads and moderate soiling (p=.007 and p=.002 respectively) and light staining (p=.031 and p=.037 respectively).

The use of tampons is predominant from the age of 17 and more high capacity tampons were discarded by Groups 2 and 3. In the sample overall, the completely saturated tampons were medium or high capacity (p=.048 and p=.004) and the partially soiled tampons also corresponded to high capacity products (p=.041). In Group 2 the trend was to discard completely saturated medium capacity tampons (p=.044) and in Group 3 completely saturated high capacity tampons (p=.018).

Significance has been observed between the mean PBAC score and the number of bleeding days. No association was observed between PBAC score and age, providing 20 points were assigned to completely saturated pads. However, when only 10 points were assigned, as recommended by Ahuja et al. [12], the PBAC score was reduced to 121.99.

The compulsory secondary education age group was characterised by lower blood loss volume when compared to subsequent phases. This is of major interest for primary healthcare services since it is usually at this time when the first consultation is sought due to bleeding problems, at an age when HMB incidence is at 20% according to some authors [2].

In the group that was in the phase we have considered as transitional, intermediate PBAC scores were identified, in comparison to the other two groups, with an average of 173,96, closer to the older age group. Participants in this transitional group discarded more medium capacity pads that were moderately soiled (p=.018 and p=.007) and the completely saturated tampons were medium capacity products (p=.044). This could point to feelings of personal insecurity leading to a tendency to hide menstruation, and reduce the need to change sanitary pads and tampons, in order to minimize the effect of menstruation on academic activities.

It is interesting to note that the university students group presented a similar average PBAC score (slightly higher) to the previous phase, but with greater use of high capacity products. This may suggest an increase in the rate of HMB in this group and therefore this phase should be considered worthy of special attention aimed at preventing the associated risks, such as ferropenic anaemia, as mentioned by Philips et al. [9].

PBAC is presented in the literature as a method for the diagnosis of HMB in which a PBAC score of 100 is equivalent to approximately 80cc of menstrual blood loss [19]. In our study 20% of participants exceeded this score, but we did not determine the cause, as that did not fall within the aims and inclusion criteria of our study.

In addition to the PBAC score, some studies take further criteria into account such as serum ferritin and hematimetric parameters [10]. Laboratory tests did not form part of the current study. Participants were asked to state whether they expelled clots during their period and an affirmative answer was given by 38% of participants. It was proven that this was linked to age (Group 1: 0%; Group 2: 26.1%; Group 3: 50%) (p=.007). The overall figures are higher than those given by Bata et al. [20] but lower than Sánchez et al. [2].

Measuring menstrual blood loss volume can be useful in primary care clinical practice as it detects women with a high risk of suffering HMB without using hematological methods [9,21,22]. However, the use of PBAC in non-experimental situations may not be widely accepted by women who do not wish to be obliged to fill out a chart on a daily basis. This drawback was already in evidence when recruiting participants for the present research, as only 30% completed the study.

The present study contributes some novel aspects. Firstly, it shows that the youngest participants used fewer MHP. Secondly, the study, unlike other studies in the literature, has the special feature of having identified the participants' preference for certain MHP with a specific absorption capacity. Thus, an attempt has been made to offset the bias constituted by the tendency of young women to use low absorption capacity products. If this had not been the case, there would have been an increase in the number of MHPs discarded and a corresponding increase in the PBAC score, data which is not taken into account in the majority of studies consulted, and which has determined a preference for certain low and medium absorption capacity MHP.

It has also detected the trend to change such products when they are moderately soiled or only lightly stained. Finally, the subjects of this study were healthy women recruited outside healthcare settings.

Further limitations of the study stem from not having included the age of menarche, the history of hormone use, family history of bleeding disorders, or personal history of haemorrhage in surgical procedures.

Conclusion

The significance of the results observed requires confirmation in further studies which should include a larger sample, with the same age range but from different population groups, and using different menstrual hygiene products such as the moon cup or sanitary pads with superabsorbent polymers, since PBAC scores are influenced by individual preferences which are sometimes difficult to quantify. This would facilitate identification of women at risk from menstrual bleeding disorders and enable appropriate measures to be taken, particularly in womens' health clinics in primary care.

Recommendations

The low intra-individual variability rate of PBAC scores may help to evaluate situations such as HMB and decide whether to administer some form of non-hormonal treatment with the aim of improving bleeding patterns in those women who require treatment for personal reasons or, for example, are not taking combined hormonal contraceptives.

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Acknowledgements

Thanks to AF Duran Alcalá and I Rodríguez Peralta for their contribution to the recruitment of the participants, A.R. Sánchez for introducing the data into the SPPSS v20 statistics package, and to the Antonio Chamorro-Alejandro Otero Research Chair, University of Granada.

Author Contributions

The protocol was conceived and designed by E Barranco-Castillo. Data collection was supervised by D Molina-Muñoz and R Martos-García. Statistical analysis and the final draft of paper was the work of E Barranco-Castillo, R Martos-García, D Molina-Muñoz and A Bueno-Cavanillas. The authors declare not to have a conflict of interests.

Funding

Antonio Chamorro-Alejandro Otero Research Chair, University of Granada. Project approved at the Research Chair's Council meeting held on 13th July 2014.

Competing Interests

None declared

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