Obesity and Menorrhagia: - Dependence, Causes & Financial losses

Jaskaran S. Gill, Laraib Artaza, Alice Niangthianhoih, Himani

Abstract— Body weight effect on Menstrual period flow currently faces a significant study gap. It is a well-established fact that Obesity/Higher BMI leads to oligomenorrhea, amenorrhea or irregular periods. The present study aims to verify this claim and further investigate the link between BMI (Body Mass Index) and menstrual flow volume. "The irritability during periods", "preference of sanitary napkins", "predictability of the start date of menstruation" with other statistics are also measured in this study. In this study, the online survey was distributed to the reproductive mature females between the age of 18 and 28. Respondents were required to fill their reproductive and menstrual history with their BMI. Responses are analyzed using the chi-square independence of attributes test. The result suggests women with higher BMI/Obese are more likely to have heavier period flow as compared to women which are underweight and in the normal range of BMI. This result is conflicting with the current understanding of the obesity relation with amenorrhea.

Index Terms— Endometrial line repair, Obesity, Mensturation, Menorrhagia, Heavy Menstrual Bleeding, Gender Equality.

1 INTRODUCTION

Body weight effect on Menstrual period flow currently faces significant study gap. It is a well-established fact that Obesity/Higher BMI leads to oligomenorrhea, amenorrhea or irregular periods (Seif MW, Diamond K, Nickkho-Amiry M., 2015) [1]. The present study aims to verify this claim and further investigate the link between BMI (Body Mass Index) and menstrual flow volume. "The irritability during periods", "preference of sanitary napkins", "predictability of the start date of menstruation" with other statistics are also measured in this study. In this study, the online survey was distributed to the reproductive mature females between the age of 18 and 28. Respondents were required to fill their reproductive and menstrual history with their BMI. Responses are analyzed using the chi-square independence of attributes test. The result suggests women with higher BMI/Obese are more likely to have heavier period flow as compared to women which are underweight and in the normal range of BMI. This result is conflicting with the current understanding of the obesity relation with amenorrhea.

TABLE 1
Financial costs of the HMB (Heavy Menstrual bleeding)

	QUANTITATIVE DATA	A#
1	HEALTH COST DUE TO HIGH BMI	4879 $
2	AVERAGE ANNUAL INCOME	1855 $ *
3	SHORT TERM DISABILITY COST	0349 $ **
4	DISABILITY PENSION INSURANCE	0069 $ ***
5	REDUCED PRODUCTIVITY	0358 $
6	GASOLINE USE	0030 $ ****
7	LIFE INSURANCE PREMIUM	0111 $ *****
	QUALITATIVE DATA	
1	LOSS OF WORK DAYS	1-5 DAYS
	TOTAL COST	$6,518—$8,365

TABLE 2
LEGEND

SYMBOL	MEANING / CAUTION
A#	ANNUAL COST FOR OBESE / OVERWEIGHT WOMEN
*	ASSUMING MEDIAN ANNUAL INCOME OF 32,450 $
**	55$ FOR OVERWEIGHT / 349 $ FOR OBESE
***	VALUE ONLY FOR OBESE FEMALE
****	FOR MORBIDLY OBESE PEOPLE ONLY
*****	14$ FOR OVERWEIGHT PEOPLE

Obesity and HMB has increased the overall cost of living of women with higher BMI [2],[3]. In this study we establish the link between the two to provide effective means and guidance for women to decrease their overall cost of living by managing obesity/ Reducing the BMI alone. This paper argues that an increase in BMI leads to increase in the menstrual period flow. This paper first establishes the methodology used in human research then states and discusses the results and its importance to the social sphere of gender equality.

2 METHODOLOGY

A well-established experimental procedure was followed in this study. Survey was conducted through the online platform of "Google forms". The survey was based on the CDC (Centre for Disease Control and Prevention) Reproductive health survey [5]. The survey consisted of 26 questions. Most of the questions were qualitative and calculated with the help of the Likert scale.

• *Jaskaran S. Gill is currently pursuing Bachelor's degree program in Zoology in Delhi University, India, PH-918219465226. E-mail: jaskarangill20011@outlook.com*

Respondents filled their reproductive health status. The data collected include the height (in inches) and Weight (in kg) to measure the B.M.I(Body Mass Index). The period flow was measured on the 10-point Likert scale. Respondents were also required to fill their preexisting medical condition and espe cially if they were on any hormonal supplement. Survey was conducted with complete anonymity of the respondents.
The other statistics measured were "menstrual irritability (Likert Scale 0-10)", "Sanitary Brand Preference", "Menstrual period duration", and "family history of the menstruation related disorders".
76 responses were received. The "Respondent ID' was allotted to each respondent for complete anonymity of the respondents. 3 respondents do not meet the conditions of the research as they are on hormonal supplement. Table 3 provides the Respondent ID with the hormone supplement they are on.

TABLE 1.2
Respondants on Hormone Supplement

RESPONDENT ID	HORMONE SUPPLEMENT
202155D	HIRSUTISM MED.
202106F	HEM GALPHA
202129D	KRIMSON 35

The "Period Flow" was measured on the 10 point "Likert Scale". The period flow is categorized into the three categories, shown in Table 4.

TABLE 4
Period flow category based on Likert scale

PERIOD FLOW IN 10 POINT LIKERT SCALE.	CATEGORY OF THE MENSTRUAL PERIOD FLOW.
1-3	LIGHT PERIOD FLOW
4-6	MODERATE PERIOD FLOW
7-10	HEAVY PERIOD FLOW

The Respondents B.M.I was measured. B.M.I was categorized into the three categories, shown in the Table 5.

TABLE 5
Weight categories based on B.M.I

B.M. I	CATEGORY
<18.5	UNDERWEIGHT
18.5-25	NORMAL B.M.I RANGE
>25	OVERWEIGHT

The contingency table was prepared with a vertical column indicating the "Period Flow Category" whereas the Horizontal column indicated the "B.M.I category.

METHOD USED FOR STATISTICAL ANALYSIS: -

The data of B.M.I and Period flow was "Nonparametric/ Categorical" data and the sample was "large" as a result "CHI SQUARE INDEPENDENCE OF ATTRIBUTE TEST" was performed. The "p-value" was measured using the chi-square value($\chi 2$).

TABLE 6
DESCRIPTIVE STATISTICS/DEMOGRAPHICS

PARAMETER	DATA TYPE	AVERAGE	STANDARD DEVIATION $\sqrt{s2}$ of SAMPLE	STANDARD DEVIATION $\sqrt{\sigma 2}$ of POPULATION
VALID RESPONSES	NUMERICAL	73	NOT APPLICABLE	NOT APPLICABLE
BODY WEIGHT	NUMERICAL	55.719 kg	±10.436 kg	±10.364
AGE	NUMERICAL	20.602 Years	±1.779 Years	±1.7260 Years
HEIGHT	NUMERICAL	61.978 inch (157.42 cm)	±3.54 inch	±3.51 inch
BMI	NUMERICAL	22.5767 kg/m2	±4.49 kg/m2	±4.46 kg/m2
PERIOD FLOW	LIKERT SCALE (0-5)	3.01	±0.807	±0.802
PERIOD PAIN	LIKERT SCALE (0-10)	6.0	±2.571	±2.553
IRRITABILITY DURING PERIODS	LIKERT SCALE (0-10)	6.6849	±2.488	±2.471
DAYS PERIOD LAST	NUMERICAL	4.7397 Days	±1.225 Days	±1.217 Days
BLEEDING STAIN CONCERN	LIKERT SCALE (0-10)	6.08219	±2.8370	±2.8175

3 RESULTS

The main aim of this study was to define the qualitative relationship between the "Period Flow" and "B.M.I". The chi square($\chi 2$) test of independence was performed. The $\chi 2$ value was calculated comparing the distribution of period flow with the distribution of the B.M.I (TABLE 7). A significant relation was found between the B.M.I and period flow ($\chi 2(4) = 10.73$, $p<0.5$) and the distribution was found to be right tailed. Right tail distribution indicates that there is significant positive relation between high B.M.I and Heavy period flow.

TABLE 7
TABLE 1.6 SHOWS THE DISTRIBUTION OF FREQUENCY OF DIFFERENT CATEGORIES OF B.M.I WITH THE DISTRIBUTION OF FREQUENCY OF DIFFERENT PERIOD FLOW CATEGORY. "" INDICATE THE "EXPECTED VALUE AND "*" INDICATE "THE CALCULATED (χ^2) VALUE".**

PERIOD FLOW CATE-GORY →	LIGHT PERIOD FLOW	MODERATE PERIOD FLOW	HEAVY PERIOD FLOW	GRAND TO-TAL
OVERWEIGHT (B.M.I <18.5)	6, (7.73) **(0.38) *	33, (28.33**) (0.77) *	8, (10.95**) (0.79) *	47
NORMAL B.M.I RANGE (B.M.I 18.5-25.0)	5, (2.96) **(1.41) *	5, (10.85) **(3.15) *	8, (4.19) **(3.46) *	18
OVERWEIGHT (B.M.I >25.0)	1, (1.32) **(0.08) *	6, (4.82) **(0.29) *	1, (1.86) **(0.40) *	8
GRAND TOTAL	12	44	17	73

TABLE 8
CHI SQUARE INDEPENDENCE OF ATTRIBUTE TEST PARAMETERS AND RESULT

$\chi 2$	10.733
DEGREE OF FREEDOM	4
p-VALUE	0.02973 (p<0.05)
DISTRIBUTION	RIGHT TAILED

Other Descriptive statistics / Demographics measured from the survey were tabulated in (table 6) above.
The preference of the sanitary brand was another interesting variable observed and measured. The different type of sanitary brand and count of people using it was tabulated in (table 1.8). Out of 73 valid responses only one respondent with the respondent-ID of "202175X" was found to be using napkin/cloth instead of commercial sanitary hygiene product.

TABLE 9
SANITARY BRAND AND THEIR PREFERENCE

S.NO	SANITARY BRAND	NO OF RESPONDENT USING IT	IN PERCENTAGE (%)
1.	WHISPER	33	37.50 %
2.	STAYFREE	30	34.09 %
3.	AMMY	4	04.55 %
4.	SOFY	9	10.23 %
5.	PROSAFE (PROVEDA)	1	01.14 %
6.	TISSUE/CLOTH	1	01.14 %

The pie chart illustrating the distribution of sanitary brand preference was shown in the (**Fig1**)

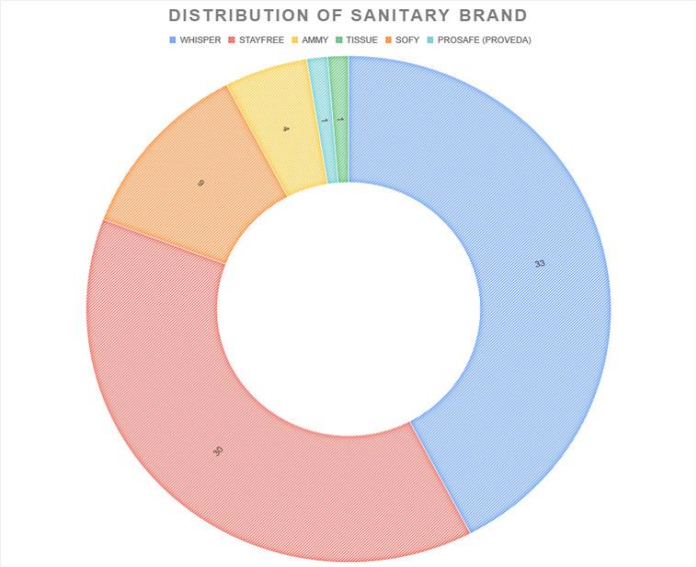
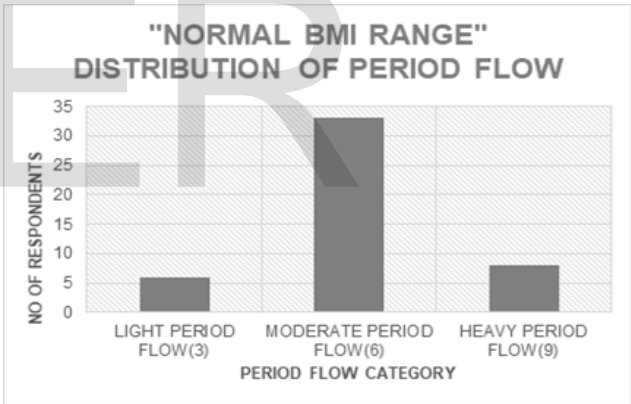
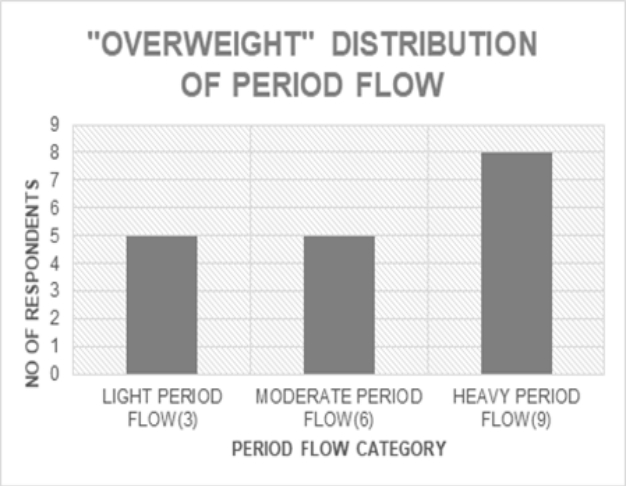


Fig1 **PIE CHART SHOWING THE DISTRIBUTION OF THE SANITARY BRAND PREFERENCE.**

The bar graph shown in fig2 shows the distribution of period flow in each B.M.I category (NORMAL BMI RANGE, OVER-WEIGHT, UNDERWEIGHT).





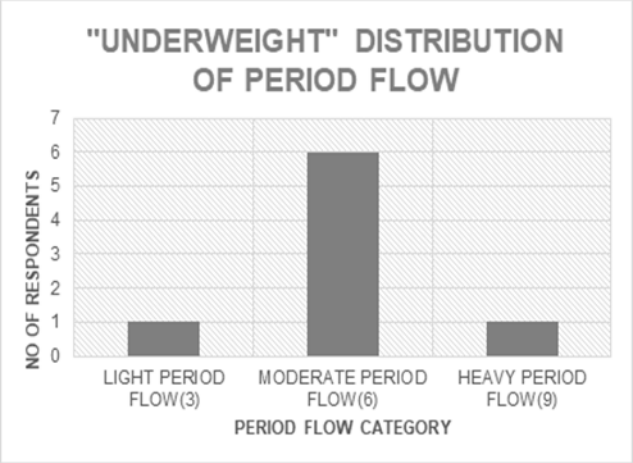


Fig2 The distribution of period flow in each B.M.I category (NORMAL BMI RANGE, OVERWEIGHT, UNDERWEIGHT)

There was no significant relation ($p>0.05$) found between the B.M.I and the predictability of the start date of the period

4 Discussion

The data suggest that people with High B.M.I have higher probability of having High Menstrual Bleeding (H.M.B). This result indicate that obese/overweight female would more likely to have H.M.B. The result met the expectation of the Hypothesis proposed.

Obesity association with H.M.B might be delayed due to the delayed endometrial lining repair (Reavey J.J, Walker C, Murray AA et al., 2021) [6]. Menstruation is associated with Hypoxia and Endometrial lining Repair. Hypoxia related genes (VEGF, ADM, CDHA, SLC2A1) showed to generally showed to have higher mean value in obese/overweight women (6).

Reavey (2021) [6] experiments on mice fed with the high fat diet demonstrate the delayed endometrial repair. Our team strongly recommends the readers to read (Reavey et al.,2021) [6] paper on correlation of endometrial lining repair with Obesity. The brilliant and insightful research of the group gives the physiological bases of the result seen in our study.

This relation between obesity and H.M.B shows that female which are obese/overweight are suffering from higher financial loss (≅ $6518-$8365 per annum) [2] due to H.M.B. The results are limited to women in the age range of 18-28. Majorityof the respondents are from south Asian descent so these results can only be generalized to the Indian subcontinent. These results do not apply to the women taking hormonal supplements or having P.C.O.S(Polycystic Ovary Syndrome).

We recommend the Govt. of India, MoHFW (Ministry of Health and Family Welfare) to subsidize the menstrual health products. We also recommend the affective counselling of obese or overweight women to have a BMI in a healthier range of <25.0. Evidence suggest that Obese women have higher chance of cardiovascular disease as compared to Obese men. Cardiovascular disease is the number one cause of mortality in the world (WHO ,2020) [7].

We also recommend the Govt. of India to subsidize the healthy food and on the other hand should increase the taxes on the fast and unhealthy food. This measure can further curb obesity in the country.

We also recommend additional/more funds to women with H.M.B to decrease their financial loss due to H.M.B. A true gender equality can only be realized in the society as a whole when it is freed from the evils of obesity or higher B.M.I.

5 Acknowledgment

We acknowledge the resources provided by the Ramjas college, University of Delhi. We also acknowledge the guidance and innovative solution provided by Dr Neelu Anand Jha, Dr Beena Bhandari. We are also thankful to Mr. Ankit Tanwar (Dept of Statistics) who provided insights and means for statistical analysis.

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7 Conflict Of Interest

The result of our study contradicts the result of Seif MW et al.,2021 [1] which concludes a positive correlation between obesity and amenorrhea/irregular periods.

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