Association Of Bmi And Waist-Hip Ratio With Menstrual Pattern In Adolescent Girls –A Cross-Sectional Study

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Abstract:
Background : Many adolescent girls suffer from menstrual problems. Although they are shy to say their problems but this affects their lifestyle and increases stress level. Menstrual problems are frequently found with abnormal BMI and abnormal body fat percentages.
Objectives : To analyze association of menstrual pattern with BMI and Waist- Hip ratio(WHR) and to find out between BMI and WHR which is more correlated with irregular menstrual pattern.
Methods : Descriptive cross-sectional study conducted in private and government schools under SMS Medical college Jaipur. Total 228 participants were included. After taking consent from parents and permission from school principal, girls were requested to complete questionnaire and data analyzed.
Results : In this study mean age of menarche was 12.8 ± 1.4 years. 64.9% were with normal BMI, 10.52% underweight,15.35% overweight, 9.21% were obese. Irregular menses were present in 30.7% of girls. Among overweight and obese girls >50% had delayed cycles with >35 days and prolonged flow > 7 days. Girls with WHR >0.8 had more irregular pattern with increased odds ratio than BMI.
Conclusion : Both BMI and WHR were significantly associated with menstrual pattern. Underweight, overweight and obese girls had more irregular menstrual pattern than to normal BMI counterparts, but cycle length >35 days and duration of menstrual blood flow >7 days was found more in overweight and obese category. Increased WHR was more significantly associated with irregular menstrual pattern than BMI.

Keywords: Adolescent girls, BMI, menstrual pattern, Waist- Hip Ratio (WHR).

Introduction :

WHO identifies adolescence as the period in human growth and development that occurs after childhood and before adulthood, from ages 10 to 19 years. It represents one of the transitions in the life span and is characterized by a tremendous pace in growth and change that is second only to infancy. The process of adolescence is a period of preparation for adulthood during which time several key developmental experiences occur. [1]

Thelarche, pubarche and menarche are the stages of puberty in adolescent girls and are essential part of their life. Menarche is beginning of menstruation and is the marker of reproductive life. Adolescent girls should know the patterns of menstruation and factors affecting it. It is a monthly regular period and remains as a normal natural biological process from menarche to menopause.[2]

Among low and middle income countries underweight, overweight and obesity are significant problems.[3][4] The menstrual abnormalities are the

common complaints encountered during adolescence and challenge for the gynaecologists also. Obesity in childhood and adolescents leads to increase risk of menstrual problem. Undernourished, overweight and obese girls have increased risk of menstrual problems.[5] This causes anxiety to adolescent girls as well as to their families. Identification of the factors affecting menstrual disorders and to educate girls so that they can self monitor their menstrual cycle and it is very important to improve health and well- being during this development phase.[6]

The purpose of this study is to analyze association of menstrual pattern with BMI and Waist- Hip ratio and to find out between BMI and WHR which is more correlated with irregular menstrual pattern so that timely actions taken to regulate menstrual cycles.

Materials And Methods :

This descriptive cross-sectional study was conducted among 228 adolescent girls from private and government school in Jaipur under SMS Medical college. This study was structured questionnaire based study, only those girls were included who volunteered for participation. Schools were recruited after prior consent of the respective principals allowing conducting present study. All the participants were introduced to the topic of study and the need to collect sensitive information and were promised confidentiality. In each case permission from parents was taken. Participants were asked to fill up a predesigned structured questionnaire which included demographic details, menstrual pattern. Weight in kg, height in cm, waist cicumference in cm, hip circumference in cm, BMI and WHR were filled in pro forma. Materials required were weighing scale, stadiometer, nonstretchable measuring tape, calculator. Body weight was weighed in kilograms using a self-zeroing weight scale with subject standing motionless in erect posture without support and shoes.[7]

Height was taken with subject standing in erect posture so that back of head, shoulder blades, heels, buttocks are brought in contact with vertical surface of stadiometer, looking directly forward with deep breath and hold the position.[7] Waist circumference was measured by palpating hip area to locate right ilium of pelvis, draw a horizontal line with cosmetic pencil just above the uppermost border of right ilium. This mark was crossed at midaxillary line, which

extend from armpit down to the side of torso. Measurements taken 3 to 4 hours after breakfast so the abdominal tension was as minimum as possible. Hip circumference was measured at the widest portion of the buttocks with participant standing erect with feet together and weight evenly distributed on both feet.[7]

BMI was calculated by dividing weight by height squared and reported in units of kg/m^2. BMI is calculated the same way for adults and children, but the results are interpreted differently. Percentile specific to age and sex classify underweight, healthy weight, overweight and obesity in children according to CDC guidelines as shown in table below.[8]

Percentile Ranking	Weight Status
Less than 5th percentile	Underweight
5th percentile to less than 85th percentile	Healthy weight
85th percentile to less than 95th percentile	Overweight
Equal to or greater than the 95th percentile	Obese

Data were collected and analyzed. Mean and Percentage values calculated. Association of BMI and WHR with menstrual pattern were calculated using chi-square test and p value. Odds ratio were calculated.

Results :

Total 228 participants were included from 12 to 19 years of age in which 98 were from government(govt.) school and 130 from private school. Mean age was 12.8 ± 1.4 years . As Table 1 shows mean weight from govt. school was 41.64 kg (SD11.23), mean height was 150.79 cm(SD8.21) and mean BMI 18.16kg/m^2 (SD 4.14). In private school girls mean weight was 46.8 kg (SD9.91), mean height was 153.29 cm(SD8.29) and BMI was 19.8kg/m^2 (3.38). p-value for BMI was significant. Likewise mean waist circumference and mean Hip circumference were also more of private school girls.

Table 2 shows that girls with normal BMI were maximum 148(64.9%), underweight 24(10.52%), overweight 35(15.35%), and obese were 21(9.21%). Table 3 shows that WHR <0.8 was in 186 (81.58%) participants and > 0.8 were 42 (18.42%) participants.

Table 4 shows association of BMI and menstrual pattern. 69.3% had regular cycles. Among irregular cycles 7.9% had <21 days cycle length and rest 22.8% had >35 days cycle length. Among overweight and obese girls more than 50% girls had delayed periods and followed by prolonged flow i.e. >7 days with heavy flow. Complain of dysmenorrhoea was only 14.2 % in overweight and 9.5% in obese participants. Among underweight 29.2% had irregular cycles and 20.8% had delayed period with 8.3% had shorter cycles. Dysmenorrhea was in 66.7%.

Table 5 shows Association between WHR and menstrual pattern. Among <0.8 WHR girls had irregular cycles in 20.4% but it was 76.2% in participants having WHR >0.8. In girls having >0.8 WHR 61.9% had delayed cycles with increased duration of flow. Dysmenorrhoea was absent in 83.3% of girls in this group.

Discussion :

In our study maximum participants were between 14 to 17 years of age group (49%). In Marri P et al[9] study 55% were from 17-18 years of age group. Mean age at menarche is 12.8 ± 1.4 years was in our study. It was 13.2 ± 0.9 years in Marri P et al[9] and 13 ± 1.1 years in study by Shabnam et al[10].

In our study 64.9% had normal BMI and 10.5% were underweight but study done by Monika Singh et al[11] only 39.5% had normal BMI and 54.3% were underweight and 6.2% were among underweight and obese category. In our study 69.3% had regular cycles and 30.7% had irregular cycles and 18.5% participants had duration >7 days. Study by Haniatri et al[12] stated that regular cycles were in 56.7% and irregular cycles were present in 43.3%. Our finding is also similar to study by Shabnam et al[10] in which 73% had regular cycles and 12% with prolonged duration.

In our study intermenstrual period <21 days was in 7.89% and cycle length >35 days was in 22.8% this finding is similar to study by Singh M et al[11] in which it was found 5.2% and 19.1% respectively.

Study done by Ganeshan D et al[13] among obese women >69% had menstrual irregularity. This correlates to our study where overall 30.7% had irregular menses among them 58.6% were overweight and obese category. Mirfat Moh et al[14] showed that irregular cycles were more common in underweight and overweight and obese category these findings are similar to our study and Jena P et al[15] where overweight and obese had longer menstrual cycle and longer duration of flow. Study by Rai P et al[16] shows that significant correlation was found between irregular cycles and high BMI $(x^2=49.826)$ $(p<0.001)$ and also significant correlation was found between very high and very low body fat percentages and menstrual irregularity. $(x^2=35.839)$ $(p<0.001)$.

In terms of amount of blood loss, heavy bleeding was present in 47.6% and 12% in obese and underweight participants respectively this finding correlates to Tang Y et al[17] which was 42% and 12% respectively in each category. But in above stated study 50% of underweight participants suffered from scanty bleeding but in our study it was only 25%.

In our study dysmenorrhea was most commonly present in underweight category that was 66.7% and with normal BMI it was 60.8% and among overweight and obese category it was quite less. Bellad C[18] studied that dysmenorrhea was more in overweight category that was 66.6%.

Several studies have been done to find out association between BMI and menstrual pattern. But BMI can not accurately measure body fat content so the findings of many studies are not very much consistent. BMI is a surrogate measure of body fatness because it is a measure of excess weight rather than excess body fat.[8] As body fat content affects menstruation by causing hormonal alterations so the work has also been done in this direction by many researchers. To decrease this shortcoming we also calculated WHR and its relationship with menstrual pattern.

By measuring BMI in our study total 56 were in overweight and obese category among 228 participants but by WHR 42 had abdominal obesity. Irregular periods were more common in participants who had abdominal obesity 76.2% were with >0.8 WHR, among them 15% had <21 days cycle and 61.9% were with >35 days cycle length and dysmenorrhea was present only in 16.7% of participants. Study by Kafaei-Atrian et al[19] stated that there was strong relationship between menstrual duration and waist to height ratio, waist to hip, hip to height and arm to height ratio. Significant association

found between anthropometric indices and menstrual characteristics. In our study the odds of having irregular menstrual cycles in WHR >0.8 (95% CI) was 3.73 which was more than odds ratio of having irregular menstrual cycles in overweight and obese category calculated by BMI (OR 3.62).

Our study findings are similar to study by Das and Dasgupta[20] where menstrual bleeding length was significantly longer in overweight participants and among those with lower body fat predominance than their respective counterparts. Cycle length was longer among obese or the participants with upper body fat predominance.

Conclusion :

Both BMI and WHR were significantly associated with menstrual pattern. Underweight, overweight and obese girls had more irregular menstrual pattern than to normal BMI counterparts, but cycle length >35 days and duration of menstrual blood flow >7 days was found more in overweight and obese category. Increased WHR was more significantly associated with irregular menstrual pattern than BMI. As ,

adolescents are shy to say their menstruation related problems so there should be awareness programs and teachings to the girls at school levels and community levels to promote their healthy life by modifying their lifestyle, physical activity and dietary pattern and controlling menstrual related problems .

Compliance : with Ethical Standards

Conflict of interest : The authors declare that they have no conflict of interest.

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Ethical standards : All procedures performed in studies involving human participants were in accordance with ethical standards of Institutional research committee and with the Helsinki Declaration of 1964 and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent : Written informed consent taken from parents of adolescent girls and permission was taken from school principals for conducting studies.

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Table 1 : Measured parameters of participants

Parameters	Govt. School	S.D.	Private school	S.D.	p-value
Mean weight (kg)	41.64	11.23	46.8	9.91	0.001(s)
Mean Height (cm)	150.79	8.21	153.29	8.29	0.001(s)
Mean Waist Circumference (cm)	69.92	7.2	72.18	5.63	0.008(s)
Mean Hip Circumference (cm)	87.4	8.19	87.82	7.03	0.82(NS)

Table 2 : According to BMI distribution of girls in govt. and private school

BMI	Govt. school girls	Private school girls	Total
Underweight	19	5	24 (10.5%)
Normal BMI	67	81	148 (64.9%)
Overweight	4	31	35 (15.3%)
Obese	8	13	21 (9.2%)
Total	**98**	**130**	**228 (100%)**

Table 3: According to WHR distribution of girls in govt. and private school

Waist-Hip Ratio	Govt. school girls	Private school girls	Total
<0.8	83	103	186 (81.6%)
>0.8	15	27	42 (18.4%)
Total	**98**	**130**	**228 (100%)**

Table 4 : BMI of participants and menstrual pattern

Menstrual pattern		Underweight	Normal BMI	Overweight	Obese	Total	χ^2, p-value
1.Cycle regularity	**Regular**	17 (70.8%)	126 (85.2%)	11 (31.4%)	4 (19%)	158 (69.3%)	65.98, p<0.0001, OR - 3.62
	Irregular	7 (29.17%)	22 (14.8%)	24 (68.6%)	17 (81%)	70 (30.7%)	
2.Cycle length	**<21 days**	2 (8.3%)	7 (4.7%)	6 (17.2%)	3 (14.3%)	18 (7.9%)	67.767, p<0.00001
	21-35 days	17 (70.9%)	126(85.2%)	11(31.4%)	4 (19%)	158 (69.3%)	
	>35 days	5 (20.8%)	15 (10.1%)	18 (51.4%)	14 (66.7%)	52 (22.8%)	
3.Duration of menstrual flow	**<2days**	1 (4.2%)	7 (4.7%)	7 (20%)	7 (33.3%)	22 (9.7%)	92.8487, p<0.00001
	3-7 days	19 (79.2%)	132(89.2%)	11(31.4%)	2 (9.5%)	164 (71.9%)	
	>7 days	4 (16.6%)	9 (6.1%)	17 (48.6%)	12(57.2%)	42 (18.4%)	
4.Amount of blood flow	**Scanty**	6 (25%)	11(7.4%)	8 (22.8%)	6 (28.6%)	31 (13.6%)	43.3818, p<0.00001
	Average	15 (62.5%)	110 (74.3%)	10 (28.6%)	5 (23.8%)	140 (61.4%)	
	Heavy	3 (12.5%)	27 (18.3%)	17 (48.6%)	10 (47.6%)	57 (25%)	

5.Dysmenorrhea	Yes	16 (66.7%)	90 (60.8%)	5 (14.3%)	2 (9.5%)	113 (49.5%)	41.1903, p<0.01
	No	8 (33.3%)	58 (39.2%)	30 (85.7%)	19 (90.5%)	115 (50.5%)	

Table 5 : Association of WHR and menstrual pattern

Menstrual Pattern		WHR<0.8	WHR>0.8	Total	χ^2, p-value
Cycle	Regular	148(78.6%)	10(23.8%)	158(69.3%)	50.07, p<0.00001, OR - 3.73
	Irregular	38(20.4%)	32(76.2%)	70(30.7%)	
Cycle Length	<21 days	12(6.5%)	6(14.3%)	18(7.9%)	52.434, p<0.00001
	21-30 days	148(79.6%)	10(23.8%)	158(69.3%)	
	>35 days	26(14%)	26(61.9%)	52(22.8%)	
Duration of Flow	<2 days	12(6.5%)	10(23.8%)	22(9.6%)	65.863, p<0.00001
	3-7 days	155(83.3%)	9(21.4%)	164(71.9%)	
	>7days	19(10.2%)	23(54.8%)	42(18.4%)	
Amount of blood loss	Scanty	19(10.2%)	12(28.6%)	31(13.6%)	38.9726, p<0.00001
	Average	132(71%)	8(19%)	140(61.4%)	
	Heavy	35(18.8%)	22(52.4%)	57(25%)	
Dysmenorrhea	Yes	106(57%)	7(16.7%)	113(49.6%)	22.285, p<0.00001
	No	80(43%)	35(83.3%)	115(50.4%)	