

A healthy habitual score for dietary intake is associated with primary dysmenorrhea among adolescent school girls

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Abstract

Background: Primary dysmenorrhea is one of the most common gynecological complaints among adolescent and young females in their reproductive age that affects their daily activities and social life. Nutritional habits are considered as risk factor for primary dysmenorrhea. Thus the aim of our study was to assess the relation between healthy habits score for dietary intake and prevalence of primary dysmenorrhea.

Methods: The present study was conducted on 432 adolescent school girls (218 girls with nil to mild dysmenorrhea and 214 girls with moderate to severe dysmenorrhea). Healthy habitual scores (HHS) was calculated from 5 modifiable dietary intake habits considering high risk habit as '0' and low risk habit as '1' giving a composite score ranging from 0 to 5. We classified the healthy life style score into three category: 0-2 as low; 3 as medium and 4-5 as high. Correlation between HHS and its components with incident of primary dysmenorrhea were evaluated. HHS and risk of primary dysmenorrhea were evaluated using logistic regression analysis. The significance level of the all the tests were considered at a level of 0.05.

Results: Significant correlation was obtained between incident of primary dysmenorrhea and all tested habits. Magnitude of correlation was higher for HHS than individual habit. Among tested habitual factors sugar intake, skipping breakfast and frequency of junk food intake was positively correlated where as negative correlation was obtained between primary dysmenorrhea and dietary intake of vit-E and calcium. Considering low HHS as reference group odd ratio significantly low in medium and high HHS groups. Thus risk of primary dysmenorrhea was more among adolescent girls those led unhealthy dietary habits like take more sugar, frequently take junk foods and skipping breakfast and take vit-E and calcium below recommended amount.

Conclusion: Avoiding of Junk food, skipping breakfast and intaking of vit-E and calcium as per recommended amount and restricting sugar intake is recommended as a healthy dietary habit to minimize the risk of primary dysmenorrhea.

Keywords: Primary dysmenorrhea; Vitamin-E; Calcium; Skipping breakfast; Junk food; Healthy habitual score

1. Introduction

Dysmenorrhea is the most common gynecological complaint among adolescent and young females in their reproductive age. It is defined as a painful cramping sensation in the lower abdomen which may also radiate to the back and thighs and occur just before or during the menstruation or both. It can be primary, in the absence of pelvic pathology (1) or secondary with demonstrable pelvic pathology such as fibroids, pelvic inflammatory disease or endometriosis (2). Primary dysmenorrhea usually starts at or shortly after menarche after establishment of ovulatory cycle (3).

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Dysmenorrhea is accompanied by various symptoms including headache, nausea, vomiting and muscle cramps. It has a negative impact on social, academic and sport activities of many adolescent girls (4). Because of painful menstrual cramp approximately 1% of women of reproductive age are unable to do their job due to severe dysmenorrhea for 1-3 days each month and approximately 14% of girls are absent from school/college for 1-2 days each month (5). Dysmenorrhea has socioeconomic impacts because of the increased need of medical care and associated medical costs as well as decreased women's effectiveness in day-to-day tasks (6). Thus dysmenorrhea is considered important in terms of its economic and social effect on women.

Nutritional habits are another risk factor for primary dysmenorrhea (7). Balanced nutritional habits, a low fat diet, and sufficient intake of protein, zinc, vitamin-E and magnesium are considered as efficient methods of reducing dysmenorrhea (8, 9). Significantly lower daily intake of vitamin-E and zinc in adolescent girls with primary dysmenorrhea than adolescent girls without primary dysmenorrhea (10). A deficiency of nutrients such as vitamin-E, vitamin-A, vitamin-C, calcium and Zinc will aggravate dysmenorrhea (11). Statistically significant association between excessive sugar intake and the presence of dysmenorrhea was reported (12). Increase sugar intake reported a mark increase of dysmenorrhea (13). The severity of dysmenorrhea was higher in women with excessive sugar intake (14).

Skipping breakfast was a risk factor of primary dysmenorrhea (15, 16). Female students who skip breakfast have a significantly higher incidence of dysmenorrhea (17). A study in Japanese young women showed that students who skip breakfast tend to experience of a higher intensity of dysmenorrhea –associated pain than those who eat breakfast regularly (18).

Despite evidence that individual lifestyle behaviours influence health outcomes, the combined effect of multiple lifestyle behaviours into a single health behaviour score may better reflect the correlation between risk factors and health outcomes (19). To date, there was increasing evidence that diminished levels of micronutrients and primary dysmenorrhea (20). Pain from dysmenorrhea can be minimized by insisting on a healthy lifestyle like avoid junk food, intake recommended amount of micronutrients like vitamins and minerals. Thus the present study was undertaken to evaluate the association between healthy habits score composed of modifiable five life style factors (junk food intake habits, sugar intake habits, habits of skipping breakfast, dietary intake of Vitamin-E and calcium) and incident of primary dysmenorrhea among adolescent girls of West Bengal, India. As a secondary objective this study explore the independent association between each HHS component and risk of primary dysmenorrhea.

2. Material and methods

2.1. Study population

The present study was conducted among adolescent students having age limit 12-18 years from schools in West Bengal, India during their school hours. The prior written permission of school authority was taken. Written consent from the parents of students experimented in the study was obtained. Students having age less than 12 years or more than 18 years, sex other than female, those who were taking regular drugs or hormonal therapy and suffering from chronic disorders including diabetes mellitus, clinically established hypertension, liver cirrhosis and kidney disease were excluded from the study. Menstrual status of 1642 adolescent girls were obtained. Out of them 432 adolescent girls (218 girls with nil to mild dysmenorrhea and 214 girls with moderate to severe dysmenorrhea) were selected for assessment of impact of healthy habitual score on primary dysmenorrhea.

2.2. Questionnaire

A self-administered questionnaire having questions related to their age, marital status, smoking habit, alcohol intake, sugar intake, dietary habit including, skipping meal and physical activities. Besides these family history regarding primary dysmenorrhea, diabetes and kidney disease also recorded.

2.3. Dietary assessment

Dietary assessment of study population was done by using 3 days diet recall questionnaire including a weekend day and two week days (21). Information from the 3 days recall included the name of food, and the portion sizes based on typical or natural portion consumed e.g. slice, piece, cup etc. Contents of nutrients like calcium and vitamin-E in intake foods were calculated using table of nutritive value of Indian food (22).

2.4. VAS (Visual Analogue Scale)

The intensity of menstrual pain was assessed by using visual analogue scale (23). The visual analogue scale is a 10 cm / 100 mm long scale. VAS had been recommended: no pain (0-4mm), mild pain (5-44mm), moderate pain (45-74mm), and severe pain (75-100mm). All students are divided into four classes on the basis of scores obtained from VAS.

2.5. Construction of healthy habitual score

A health habitual score (HHS) was estimated based on whether participants met recommendations for diet quality, intake of fast food, skipping meal and intake of sugar. We dichotomized each behavior into a low-risk and high risk group. Low and high risk groups given scores 1 and zero respectively. Summation of scores indicates HHS. We classify HHS into three category: low (score 0-2), medium (score 3) and high (score 4-5). We defined the low-risk nutrients as participant met recommendation demand, low risk for junk food if participants never or rare take junk food, low risk for sugar if participants take no sugar or take below 6 tea spoon sugar/day, low risk for skipping meal if participants never skip or skip meal maximum 1 time a week.

Table 1 Components for healthy habitual score

Healthy habitual score components	Low risk group (score=1)	High risk group (score=0)
Calcium intake	RDA	Below RDA
Vitamin-E intake	RDA	Below RDA
Junk food intake	0-1 time a week	≥ 2 time a week
Sugar intake	< 6 teaspoon of table sugar per day	≥ 6 teaspoon of table sugar per day
Skipping meal	0-1/week	≥ 1/week

2.6. Statistical analysis

Distribution of study population on the basis of dietary habit and HHS was evaluated. The association between behaviour parameters as well as HHS with primary dysmenorrhea were evaluated using chi square test. Logistic regression analysis were done to examine the association between nutritional habit and HHS with primary dysmenorrhea. We calculated odd ratios and corresponding 95% confidence of hypertension for HHS and habitual factors. Statistical significance was determine at p value <0.05.

3. Results

432 adolescent school (110 without dysmenorrhea, 108 with mild dysmenorrhea, 108 girls with moderate dysmenorrhea and 106 girls with severe dysmenorrhea) girls were included in this analysis. All the participants were non-smoker and unmarried. Among the participants 50.46% were under nil to mild dysmenorrhea and 49.54% were under moderate to severe dysmenorrhea. Distribution of study population on the basis of healthy habit score and its components with severity of menstrual pain was given in table -2. Prevalence of dysmenorrhea was more among adolescent those take calcium and vitamin-E below recommended amount. More intake of junk foods and sugar increase the prevalence of dysmenorrhea. Prevalence of primary dysmenorrhea was more among girls those skip breakfast than non-skipping counterpart.

Table 2 Distribution of study population on the basis of habitual factors and HHS

Habitual factors and healthy habitual score (HHS)		Severity of primary dysmenorrhea		
		Nil to mild	Moderate	Heavy
Sugar intake	Less	122(63.54%)	36(18.75%)	34 (17.71%)
	More	96 (40.00%)	72 (30.00%)	72 (30.00%)
Junk food intake	Less	72 (65.46%)	18 (16.36%)	20 (18.18%)
	More	146 (45.34%)	90 (27.95%)	86 (26.71%)
Skipping meal	No	172(65.65%)	62(23.66%)	28 (10.69%)

	Yes	46 (27.06%)	46 (27.06%)	78 (45.88%)
Daily calcium intake	Recommended	124 (71.26%)	28 (16.09%)	22 (12.64%)
	< Recommended	94 (36.43%)	80 (31.01%)	84 (32.56%)
Daily Vitamin-E intake	Recommended	152 (68.47%)	42 (18.92%)	28 (12.61%)
	< Recommended	66 (31.43%)	66 (31.43%)	78 (37.14%)
HHS	Low (0-2)	76 (30.65%)	82 (33.06%)	90 (36.29%)
	Medium (3)	56 (66.67%)	18 (21.43%)	10 (11.90%)
	High (4-5)	86(86.00%)	8(8.00%)	6(6.00%)
	Highest (5)	28 (87.50%)	2 (6.25%)	2 (6.25%)

Correlation between five habitual factors and incident of primary dysmenorrhea among adolescent's girls was represented in table-3. There is significant correlation between all tested habitual factors with primary dysmenorrhea. There was significant negative correlation of dietary intake of calcium and vitamin-E and significant positive correlation with intake of sugar and junk foods fruit with incident of primary dysmenorrhea. Positive correlation was noted between incidence of primary dysmenorrhea and skipping breakfast. Significant negative correlation was noted between HHS and primary dysmenorrhea.

Table 3 Correlation between severities of primary dysmenorrhea (VAS) and healthy habits

Menstrual Pain	Healthy habitual components and HHS	r	probability
Nil=1; Mild=2; Moderate=3; Heavy=4	Sugar intake (< 6 spoon/day=1; ≥ 6 spoon/day=2)	0.241	<0.001
	Junk food intake (0-2/week=1; ≥ 2/week=2)	0.297	<0.001
	Skipping breakfast (0-1/week=1; ≥ 2/week=2)	0.397	<0.001
	Calcium intake (Below RDA=1; RDA=2)	(-)0.419	<0.001
	Vitamin-E intake (Below RDA=1; RDA=2)	(-)0.387	<0.001
	HHS (0-5)	(-)0.592	<0.001

Chi square test was done to evaluate association between primary dysmenorrhea (dependent variable) and five habitual lifestyle factors (independent variables). Results suggested significant association of Junk food intake, sugar consumption, and dietary intake of calcium and vitamin-E and skipping breakfast with primary dysmenorrhea (table-4).

Table 4 Chi square test for assessment of association between the components of healthy habitual score and primary dysmenorrhea

HHS components		Severity of dysmenorrhea		Chi square value	Probability
Name	Frequency/amount of intake	Nil to mild	Moderate to severe		
Sugar intake	< 6 tea spoon/day	122	70	23.648	< 0.0001
	> 6 tea spoon/day	96	144		
Junk food Intake	0-1/week	72	38	13.268	< 0.001
	≥ 2/week	146	176		
Skipping meal	0-1/week	172	90	61.420	< 0.0001
	≥ 2/week	46	124		
Calcium	RDA	124	50	50.431	< 0.0001

intake	Below RDA	94	164		
Vitamin-E intake	RDA	152	70	59.228	< 0.0001
	Below RDA	66	144		

Bivariate analysis was done to evaluate the risk of primary dysmenorrhea and HHS. Considering low HHS as reference, odd ratio was less in middle and high HHS group (table-5). This result suggested that risk of primary dysmenorrhea was least among high HHS group.

Table 5 Bivariate regression analysis of primary dysmenorrhea and components of healthy habitual score (HHS)

HHS components	Frequency/ amount	Severity of dysmenorrhea		Odd ratio	95% CI	p
		Nil to mild	Moderate to severe			
Sugar intake	Less	122	70	1.0000	Ref	
	More	96	144	2.6143	1.7678—3.8680	<0.0001
Junk food intake	Never to rare	72	38	1.0000	Ref	
	Regular	146	176	2.2841	1.0957—1.8096	0.0075
Skipping breakfast	No	172	90	1.0000	Ref	
	Yes	46	124	5.1517	3.3724—7.8697	< 0.0001
Calcium intake	≥ RDA	124	50	1.0000	Ref	
	< RDA	94	164	4.3268	2.8576—6.5514	0.0003
Vit-E intake	≥ RDA	152	70	1.0000	Ref	
	< RDA	66	144	4.7377	3.1560—7.1121	< 0.0001

Table 6 Bivariate regression analysis of primary dysmenorrhea according to healthy habitual score (HHS)

HHS	VAS: 0-44mm	VAS: 45-100 mm	Odd ratio	95% CI	p
0-2	76	172	1.00 (Ref)	-----	-----
3	56	28	0.2209	0.1303to 0.3746	<0.0001
4	86	14	0.0719	0.0385to 0.1345	<0.0001
5	28	4	0.0631	0.0214 to 0.1862	<0.0001

4. Discussion

This study showed that HHS was associated with lower prevalence of primary dysmenorrhea. This association was stronger for HHS than individual components suggesting that there may be a synergistic effect among risk factors. Nutritional habits are considered as risk factor for primary dysmenorrhea (7). Considering this we have evaluated the impact of HHS for dietary intake using five modifiable risk factors like frequency of junk food intake, daily intake of sugar, frequency of skipping meal, dietary intake of one macro element viz calcium and dietary intake of one antioxidant vitamin viz. vit-E.

Female students who skip breakfast have a significantly higher incidence of dysmenorrhea and associated pain in respect to counterpart those take breakfast regularly (18) suggesting skipping breakfast as a risk factor of primary dysmenorrhea. Our results also suggested that skipping breakfast increases the risk of primary dysmenorrhea (OR: 5.152, 95% CI: 3.372-7.870; p: 0.0001). Although the mechanisms underlying the adverse effect of skipping breakfast are unclear. A research argues that women with a quality breakfast gained a higher micro nutrients intake, while

skipping breakfast cause deficiency of vitamin-A, vitamin-B6, calcium, Zinc, magnesium and copper (17). All these nutrients affects dysmenorrhea.

Results of our study suggested that dietary intake of calcium significantly associated and negatively correlated with primary dysmenorrhea. Prevalence of primary dysmenorrhea was less among adolescent female those take calcium as recommended amount in compare with female adolescent those take calcium below recommended amounts. Calcium intake below recommended daily allowance (RDA) have significantly higher risk of dysmenorrhea than adolescent female those take calcium as RDA (OR: 4.327, 95% CI: 2.858-6.551; p: 0.0003). Previous observation of suggested that primary dysmenorrhea is related to insufficient calcium consumption (24). Thus our result coincides with previous observation. Calcium plays a key role in the membrane fixation mechanism and can modulate synapses. Thus reduction in calcium levels increase synaptic transmission and consequently dysmenorrhea (25).

Many studies reveal a significant rise in the level of $\text{PGF}_{2\alpha}$ and PGE_2 during menstruation that induce intense uterine muscle contraction and cramp (26, 27). Prostaglandin derive from arachidonic acid through enzymatic action of cyclooxygenase and lipoxygenase. An increased activity of these enzymes has been observed in women with dysmenorrhea (28). The decline in progesterone levels in the late luteal phase is associated with release of lysosomal enzyme, phospholipase A2 resulting in formation of arachidonic acid from membrane phospholipid. Arachidonic acid enters into cyclooxygenase pathway to produce prostaglandins (26, 29). Prostaglandins are inflammatory, producing both uterine cramps and systemic symptoms of nausea, vomiting and headache (30). Particularly $\text{PGF}_{2\alpha}$ and PGE_2 cause potent vasoconstriction and myometrial contractions, leading to uterine ischemia and consequently causing pain (31). Several studies revealed that dysmenorrheic females have higher level of prostaglandins than eumenorrheic females (32). Dawood 2006, suggested that menstrual cramps, pain intensity, and associated symptoms are directly correlated with higher concentration of $\text{PGF}_{2\alpha}$ and PGE_2 in the endometrium (33). Vit-E displays an inhibitory role in the release of arachidonic acid and its conversion to prostaglandin via action on the enzyme phospholipase A2 and cyclooxygenase (34). Vit-E supplementation is capable of alleviating dysmenorrhea (35, 36). Thus deficiency of vit-E increase the risk of primary dysmenorrhea. Result of this study suggested that vit-E intake below recommended daily allowance (RDA) have significantly higher risk of dysmenorrhea than those take vit-E as RDA amount (OR: 4.738, 95% CI: 3.156-7.112; p: 0.0001).

Results of our study suggested that sugar intake significantly associated and positively correlated with primary dysmenorrhea. Excessive sugar intake increases the risk of primary dysmenorrhea by 2.6 times than low sugar intake counterpart (OR: 2.614, 95% CI: 1.767-3.868; p: 0.0001). This result coincide with previous studies (13, 14). A recent systematic review suggested that high intake of sugar increased menstrual cramps by increasing the production of prostaglandins (37).

To the best of our knowledge this is the first study that focuses on the association of HHS with primary dysmenorrhea in adolescent Indian girls. This study showed that higher HHS was associated with a reduced risk of primary dysmenorrhea. Our findings support the evaluation of multiple lifestyle factors in relation to health outcomes. The design of interventions that target multiple lifestyle factors and shared drivers of these factors is likely to be an effective and efficient public health strategy.

5. Conclusion

We have observed that there was a significant correlation between HHS and its components with primary dysmenorrhea. But this association was stronger for HHS than individual components suggesting that there may be a synergistic effect among risk factors. The present study also showed that prevalence of primary dysmenorrhea was lower in individual who had no or rare habit to skip breakfast, never of rare junk food intake habit, Low sugar intake habit and take vit-E and calcium as per RDA. On the basis of our finding, we concluded that greater adherence to healthy habits in relation to dietary intake as assessed by higher HHS, is associated with a reduced risk of primary dysmenorrhea in adolescent girls. Thus adherence of these healthy lifestyle recommendations is likely to be beneficial to minimize medical and financial burden for primary dysmenorrhea.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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