

RESEARCH ARTICLE

Association Between Simple Carbohydrate Intake and Menstrual Duration Among Female Medical Students Of The Faculty Of Medicine Muhammadiyah University of North Sumatra

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Introduction: Menstruation is a physiological process heavily influenced by metabolic and endocrine pathways. Modern dietary shifts, particularly the high intake of simple carbohydrates, can disrupt glucose homeostasis and insulin sensitivity, potentially altering reproductive hormone regulation and menstrual characteristics. This study aims to determine the association between the frequency of simple carbohydrate intake and menstrual duration among female medical students at the Muhammadiyah University of North Sumatra (UMSU). **Method:** An analytical observational study utilizing a cross-sectional design was conducted with 90 female medical students. Dietary patterns were assessed using a Food Frequency Questionnaire (FFQ) to categorize simple carbohydrate consumption (<3x/week vs. >3x/week). Menstrual duration was recorded and categorized as normal (<8 days) or prolonged (>8 days). Data were analyzed using the Chi-square statistical test. **Results:** The cohort was predominantly 19 years old. A significant majority of respondents (73.3%, n=66) reported frequent consumption of simple carbohydrates (>3x/week). Analysis revealed a statistically significant association between high-frequency simple carbohydrate intake and prolonged menstrual duration ($p < 0.01$). All respondents in the infrequent consumption group (<3x/week) exhibited normal menstrual duration. **Discussion:** There is a significant positive association between high dietary intake of simple carbohydrates and prolonged menstrual bleeding duration. These findings underscore the critical need for nutritional education emphasizing glycemic control to support reproductive health in young adult women.

Keywords: Food frequency questionnaire, Menstrual duration, Reproductive health, Simple carbohydrates

INTRODUCTION

Menstruation is a physiological process that occurs periodically in women as a result of hormonal changes that function to

prepare the body for the reproductive process. Although it is a natural process, not all women experience regular menstrual cycles. ¹ According to data from the World Health Organization, more than 75% of

women worldwide experience menstrual disorders, with the highest prevalence in the United States at 94.9% and the lowest in Korea at 19.4%.²

In Indonesia, according to Riskesdas data, around 68% of women aged 10-59 years experience regular menstruation, while 13.7% experience menstrual irregularities in the past year.³ Factors such as nutritional intake, particularly simple carbohydrate intake, are thought to contribute significantly to menstrual irregularities.⁴ Simple carbohydrates, which are composed of monosaccharides and disaccharides, are found in many processed foods and sugary drinks.⁵ Excessive consumption of simple carbohydrates can affect glucose and insulin levels in the body, which in turn can lead to hormonal disorders that impact the regularity of the menstrual cycle.⁶ So that the researcher is interested in researching about, "The Relationship between Simple Carbohydrate and Menstruation Regularity in Female Students of the Faculty of Medicine, University of Muhammadiyah North Sumatra".

METHODS

An analytical observational study utilizing a cross-sectional design was conducted at the Faculty of Medicine, Muhammadiyah University of North Sumatra (UMSU), commencing in March 2024.

To isolate the association between dietary intake and menstrual duration, strict

selection criteria were enforced to control for major metabolic and endocrine confounders. Inclusion criteria required participants to be female medical students aged 17–24 years who provided written informed consent. Crucially, the exclusion criteria eliminated individuals who were currently pregnant or lactating, those actively utilizing hormonal pharmacotherapy (e.g., oral contraceptives), and those with a documented clinical history of reproductive or endocrine disorders (such as Polycystic Ovary Syndrome [PCOS])

The study population comprised female medical students enrolled at UMSU. The minimum required sample size was determined prior to data collection using GPower software (version 3.1). Based on a Chi-square test framework with a medium effect size (0.3), an alpha error probability of 0.05, and a statistical power of 0.80, the minimum required sample was calculated at 88 respondents. Ultimately, 90 participants were successfully recruited utilizing a consecutive sampling technique, wherein every subject meeting the selection criteria was enrolled until the quota was fulfilled.

Primary data were collected via direct anthropometric measurement and self-administered questionnaires. Initial demographic profiling included the measurement of body weight and height to assess baseline nutritional status (Body Mass Index).

The independent variable, simple carbohydrate intake, was assessed utilizing an internationally standardized Food

Frequency Questionnaire (FFQ). The FFQ was utilized to capture the consumption frequency of refined, high-glycemic foods and beverages over a defined period. Based on the aggregated FFQ scores, dietary intake was dichotomized into two ordinal categories: Infrequent consumption (<3 times/week) and Frequent consumption (>3 times/week).

The dependent variable, menstrual duration, was assessed via a targeted reproductive health questionnaire. To maintain clinical precision and differentiate from general cycle regularity, menstrual duration was strictly defined as the number of bleeding days per cycle and categorized as either Normal (≤ 8 days) or Prolonged (> 8 days).

This study was conducted in strict adherence to the Declaration of Helsinki and received formal ethical approval from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, UMSU (Approval Number: 1164/KEPK/FKUMSU/2024). Written informed consent was obtained from all respondents prior to any data collection.

Data processing (editing, coding, entry, cleaning, and tabulating) was executed meticulously prior to analysis. Statistical evaluation was performed using SPSS software. Following descriptive univariate profiling, a bivariate Chi-square test was conducted to determine the statistical significance of the association between the frequency of simple carbohydrate intake and menstrual duration.

The threshold for statistical significance was established at $p < 0.05$.

RESULTS

Table 1. Sample Distribution

Characteristics	Frequency (n)	Percentage (%)
Age of Menarche		
< 12 Years	17	18.9
12 – 13 Years	55	61.1
> 13 Years	18	20
Nutritional Status (BMI)		
Underweight	8	8.9
Normal Weight	62	68.9
Overweight	7	7.8
Obese Class I	7	7.8
Obese Class II	6	6.7
Menstrual Cycle Length		
< 21 Days (Polymenorrhea)	15	16.7
21 – 35 Days (Normal)	69	76.7
> 35 Days (Oligomenorrhea)	6	6.7
Menstrual Bleeding Duration		

Normal (≤ 8 Days)	65	72.2
Prolonged (> 8 Days)	25	27.8
Simple Carbohydrate Intake		
Infrequent ($< 3x/week$)	24	26.7
Frequent ($> 3x/week$)	66	73.3

A total of 90 female medical students met the inclusion criteria. The median age of the cohort was 19 years (range: 18–20 years). As detailed in Table 1, the majority of respondents possessed a normal Body Mass Index (68.9%) and reported a normal menstrual cycle length of 21–35 days (76.7%). Regarding dietary habits, a significant majority (73.3%) reported frequent consumption of simple carbohydrates (>3 times/week).

Table 2. Bivariate Analysis

Simple Carbohydrate Intake	Normal Duration (≤ 8 Days) n (%)	Prolonged Duration (> 8 Days) n (%)	Total n (%)	p-value
Infrequent ($< 3x/week$)	24 (100.0)	0 (0.0)	24 (100)	
Frequent ($> 3x/week$)	41 (62.1)	25 (37.9)	66 (100)	< 0.001

The analysis (Table 2) demonstrates a highly significant positive association

between high-frequency simple carbohydrate consumption and prolonged menstrual duration ($p < 0.001$). Notably, all respondents (100%) in the infrequent consumption group exhibited normal menstrual duration, whereas 37.9% of the frequent consumption group experienced prolonged menstrual bleeding extending beyond 8 days.

The results of the chi square statistical test showed $p=0.001$ ($p<0.05$) which indicated a relationship between simple carbohydrate intake and menstrual regularity based on duration in female students of the Faculty of Medicine, University of Muhammadiyah North Sumatra.

DISCUSSION

The results of this study demonstrate a highly significant, positive association between frequent simple carbohydrate consumption ($>3x/week$) and prolonged menstrual duration (>8 days) among female medical students ($p < 0.001$). This finding aligns with emerging reproductive endocrinology literature highlighting the impact of high-glycemic diets on the female reproductive axis.⁷

While simple carbohydrates are fundamental for rapid energy metabolism, their systemic impact is dictated by their nutritional source. Naturally occurring simple carbohydrates, such as fructose in fruits and lactose in dairy, are typically co-ingested with essential micronutrients, dietary fiber, calcium, and vitamin D, which

modulate their absorption and provide physiological benefits.⁸

Conversely, the frequent consumption reported in this study likely stems from ultra-processed items, refined wheat flours, and sugar-sweetened beverages that provide high caloric density but are devoid of supplementary nutritional value.⁹

The chronic ingestion of these high-glycemic empty calories leads to rapid hepatic processing and subsequent lipogenesis, which elevates serum triglycerides and promotes visceral fat accumulation. This lipogenic pathway is a primary precursor to obesity and subsequent insulin resistance, conditions intrinsically linked to the pathogenesis of diabetes mellitus.¹⁰

The accumulation of these macronutrients significantly alters reproductive physiology; while a normal menstrual cycle optimally ranges from 25 to 35 days, obesity driven by continuous carbohydrate accumulation acts as a major independent risk factor for cycle abnormalities.¹¹

The conversion of excess glucose into adipose tissue has direct endocrine consequences. Visceral adipose tissue acts as an active endocrine organ that autonomously synthesizes estrogen. This continuous, exogenous elevation of estrogen levels triggers a compensatory increase in androgenic hormones, which actively

disrupts the maturation of ovarian follicles and destabilizes the menstrual cycle.¹²

The demographic concentration of 19-year-old respondents in this cohort is clinically relevant, as late adolescence is a transitional developmental period characterized by a high susceptibility to functional menstrual disorders.¹³ Furthermore, chronological age in this demographic strongly correlates with reproductive health literacy; the depth of a patient's knowledge significantly influences behavioral practices, including the maintenance of genital hygiene and overall reproductive self-care, which can indirectly impact pelvic health during menstruation.¹⁴

The observed menarcheal age of 12 to 13 years aligns with epidemiological averages for adolescents possessing normal nutritional status, indicating that initial reproductive maturation was unhindered.¹⁵ Additionally, the overarching cycle lengths largely remained within the normative 21 to 35-day physiological window, consistent with established reproductive parameters.¹⁶ However, while the macro-cycles appeared regular, the functional desquamation process which physiologically should resolve within 3 to 7 days was significantly prolonged (>8 days) in the high-carbohydrate group.¹⁷

The dominance of simple carbohydrate consumption (>3x/week) presents a complex metabolic paradigm. Physiologically, increased carbohydrate intake is demanded during the luteal phase to maintain hormonal stability and prevent

premature luteal phase shortening.¹⁸ The bivariate Chi-square analysis confirms a highly significant association between this high frequency of intake and prolonged bleeding duration ($p=0.000$).¹⁹ However, it is essential to contextualize these findings within broader literature; comparative studies utilizing alternative statistical models, such as the Gamma test, have occasionally found non-significant associations between overarching carbohydrate adequacy and macro-cycle regularity.²⁰

This discrepancy highlights that frequent simple carbohydrate intake disrupts the micro-architecture of the bleeding phase through complex endocrine pathways. The chronic adiposity induced by this diet triggers systemic inflammation, which stimulates an increased pulsatility of Gonadotropin-Releasing Hormone (GnRH) in the hypothalamus. This subsequently elevates Luteinizing Hormone (LH) secretion, driving excessive ovarian androgen production (hyperandrogenism) while concurrently suppressing Follicle-Stimulating Hormone (FSH). This elevated LH-to-FSH ratio impairs normal folliculogenesis and destabilizes the endometrial lining, ultimately manifesting as the prolonged menstrual duration observed in this cohort.²¹

Several methodological limitations must be acknowledged. Primarily, the cross-sectional design only establishes an association between simple carbohydrate intake and menstrual duration; it inherently

precludes the establishment of temporal causality. Secondly, while major clinical confounders (e.g., active hormonal contraceptive use and diagnosed PCOS) were controlled via strict exclusion criteria, the study did not conduct multivariate statistical adjustments for other critical lifestyle variables that influence menstruation, including psychological stress levels, daily physical activity, sleep quality, and precise total caloric intake. Finally, the FFQ utilized, while standardized, relies on retrospective self-reporting, which is susceptible to recall bias. Future longitudinal cohort studies incorporating robust multivariate regression analyses are required to isolate the specific impact of high-glycemic diets on reproductive health.

CONCLUSION

This study demonstrates a statistically significant association between high-frequency simple carbohydrate intake and prolonged menstrual bleeding duration among young adult women. Frequent consumption of high-glycemic diets likely contributes to prolonged menstrual duration via metabolic pathways involving insulin resistance, altered estrogen metabolism, and systemic inflammation. These findings highlight the critical necessity for targeted nutritional interventions and dietary education aimed at optimizing glycemic control to support reproductive health and mitigate the risk of prolonged menstrual duration in this demographic.

REFERENCES

1. Villasari A. *Fisiologi Menstruasi*. Strada Press; 2021.
2. Saintika JM, Pebrina M. Hubungan Status Gizi Dengan Keteraturan Siklus Menstruasi Pada Siswi Remaja Di SMA N 12 Padang Tahun 2015. 2016;7.
3. Kementerian Kesehatan RI. *Laporan Nasional Riskesdas 2017*.; 2017.
4. Maedy FS, Permatasari TAE, Sugiatmi S. Hubungan Status Gizi dan Stres terhadap Siklus Menstruasi Remaja Putri di Indonesia. *Muhammadiyah J Nutr Food Sci*. 2022;3(1). doi:10.24853/mjnf.3.1.1-10
5. National Center for Health Statistics. *Health, United States 2020-2021*.; 2020.
<https://www.cdc.gov/nchs/healthdata/content/2020-2021.htm#Table-McrNutr>
6. Aydın B, Winters SJ. Sex Hormone-Binding Globulin in Children and Adolescents. Published online March 2016.
7. Moore DR, Sygo J, Morton JP. Fuelling the female athlete: Carbohydrate and protein recommendations. *Eur J Sport Sci*. 2022;22(5). doi:10.1080/17461391.2021.1922508
8. Drula E, Garron ML, Dogan S, Lombard V, Henrissat B, Terrapon N. The Carbohydrate-Active Enzyme Database: Functions And Literature. *Nucleic Acids Res*. 2022;50(D1). doi:10.1093/nar/gkab1045
9. Firdiansyah RD, Habibah SS, Utami NK. Pengaruh Mengkonsumsi Karbohidrat Sederhana (Biskuit Kelapa) Dan Karbohidrat Kompleks (Pisang Ayam) Terhadap pH Saliva. *J Ter Gigi dan Mulut*. 2021;1(2).
10. Yuliani R, Suparman, Maryati, Witri DP. *Gambaran Asupan Karbohidrat Sederhana, Asupan Serat, Indeks Massa Tubuh (IMT) Dan Kadar Glukosa Darah Sewaktu Pada Pasien Rawat Jalan Di Puskesmas Cimahi Selatan Kota Cimahi*.; 2020.
11. Yakoba MS, Mudayatiningsih S, Dewi N. Hubungan Obesitas Dengan Gangguan Menstruasi Pada Remaja Putri Di Kelurahan Tlogomas. 2018;3.
12. Jewson M, Purohit P, Lumsden MA. Progesterone And Abnormal Uterine Bleeding/Menstrual Disorders. *Best Pract & Res Clin Obstet & Gynaecol*. 2020;69. doi:10.1016/j.bpobgyn.2020.05.004
13. Sefti IJ, Franly R. Hubungan Dismenore Dengan Gangguan Siklus Haid Pada Remaja Di SMA N 1 Manado. 2019;7.
14. Ayu AD, Sinulingga P. Pengetahuan Remaja Putri Tentang Menarche. *J Ilm Keperawatan Imelda*. 2020;6(2). doi:10.52943/jikeperawatan.v6i2.405
15. Yulita C, Devitasari I, Delika M. Gambaran Menarche pada Remaja Siswi di Sekolah Menengah Pertama Negeri-14 Palangka Raya. *J Surya Med*. 2022;8(2). doi:10.33084/jsm.v8i2.3856
16. Purwaningtias RM, Puspitasari D, Ernawati E. The Relationship Between

Menstrual Cycle Characteristics With Dysmenorrhea and Adolescents Social Life. *Indones Midwifery Heal Sci J*. 2021;4(3).

doi:10.20473/imhsj.v4i3.2020.280-294

17. Firzaman DM, Alatas HS, Ernawati E. Karakteristik Durasi Menstruasi Pada Kasus Oligomenorhea Mahasiswa Stik Budi Kemuliaan Tahun 2021. *J Kebidanan dan Kesehat Reproduksi*. 2022;1(1). doi:10.61633/jkkr.v1i1.5

18. Sitoayu L, Pertiwi DA, Mulyani EY. Kecukupan zat gizi makro, status gizi, stres, dan siklus menstruasi pada remaja. *J Gizi Klin Indones*. 2017;13(3). doi:10.22146/ijcn.17867

19. Fajarwati SH. Hubungan Tingkat

Kecukupan Karbohidrat Dan Tingkat Stres Dengan Siklus Menstruasi Siswi Pesantren Kelas VIII Mts N1 Tegal. *Sci (80-)*. 2022;7(1).

20. Tsamara G, Raharjo W, Ardiani Putri E. Hubungan Gaya Hidup Dengan Kejadian Dismenore Primer Pada Mahasiswi DI Universitas Tanjungpura. 2020;2.

21. Marlina U, Maulitanti SD, Annisa Y, Masitha D. Pengaruh Penerapan Diet Anti Inflamasi Pada Perubahan Manifestasi Klinis Dan Penanda Inflamasi Wanita Dengan Polycystic Ovary Syndrome (PCOS). *J Pendidik Indones*. 2023;4(05). doi:10.59141/japendi.v4i05.1821