

Assessment of trace elemental composition, sex hormones and antioxidant capacity of young women with menstrual irregularities

ABSTRACT

Trace elemental composition, sex hormones and antioxidant capacity of young women with menstrual irregularities were assessed in this study using standard methods. Forty (40) young female subjects with regular menstrual cycle and 40 young female subjects with different kinds of menstrual irregularities, totally to 80 volunteer subjects were used for the study. The subjects were sourced from the duo of Imo State University and Federal Medical Centre, both in Owerri, Nigeria. Each volunteer subject signed an informed consent form after the procedure and implications of the study were explained using a language the subject would understand. Trace elements such as zinc, copper, iron and selenium; and antioxidant capacity assessed were insignificantly ($p > 0.05$) affected in test subjects when compared to control subjects. Estrogen and sex hormone binding globulin (SHBG) levels were significantly ($p < 0.05$) decreased in test subjects against the control subjects. The reduction in levels of estrogen and SHBG could be indication that menstrual irregularities of the test subjects may have been linked to hormonal imbalances.

Keywords: Antioxidant capacity, sex hormone, young women, menstrual irregularities.

1.0 INTRODUCTION

Menstruation period is a period that reveals the reproduction status of an average women [1]. It is associated with changes that occur in the female reproductive system and has a cycle [1-2]. Menstrual cycle is associated with different signs and symptoms which become climaxed, when blood begins to come out from the genital of a woman to the exterior [3]. Menstruation and menstrual cycle are sometimes influenced by certain negative factors. With such factors, the cycle sometimes is faced with numerous challenges which make it infrequent [4]. In such situation, menstrual abnormalities also known as menstrual irregularities set in [1-4].

Menstrual irregularities could be as a result of amenorrhea, oligomenorrhea, dysmenorrhea or abnormal uterine bleeding. Amenorrhea is described as a condition when the period of a woman stop completely. It is also associated with lack of period in a woman at 16 years of age [1-4]. Outside pregnancy, breastfeeding or menopause, the absence of period for 90 days or more in a woman is abnormal [5]. When the period is infrequent, it is described as oligomenorrhea. Severe menstrual cramps and painful period are associated with dysmenorrhea [6]. A heavier menstrual flow, a period that last longer than seven days, bleeding or spotting between periods, after sex or after menopause could be among the known variety of menstrual irregularities that manifest as abnormal uterine bleeding [7]. Stress, birth control pills, fibroids, endometriosis, pelvic inflammatory disease (PID), polycystic ovary syndrome, steroid drugs, premature ovarian insufficiency, cervical cancer, and anticoagulant drugs have been reported as the underlying causes of menstrual irregularities [8-10]. Since stress is among the underlying causes of menstrual irregularities, it

therefore means that the role of antioxidants may become particularly important in the body in such condition [11].

Trace elements are required in minute quantity by humans and are constantly found in blood fluid due to their strategic functions in the body [11]. Zinc (Zn), selenium (Se), chromium (Cr) cobalt (Co), iodine (I), manganese (Mn), molybdenum (Mo), and copper (Cu) are among the essential trace elements of the human body [11]. Hidioglou [11] noted that various minerals such as copper, cobalt, selenium, manganese, iodine, zinc, and iron can influence reproductive performance. The same author further noted that reproductive failure may be induced by deficiencies of single or combined trace elements and by imbalances.

Due to paucity of studies on menstrual irregularities in women, the present study assessed the trace elemental composition, sex hormones and antioxidant capacity of young women with menstrual irregularities.

2.0 MATERIALS AND METHODS

2.1 Study Area

The combined subjects from Imo State University and Federal Medical Centre were used in the present study. Imo State University and Federal Medical Centre are both located in Owerri. Owerri is the capital city of Imo State. It is found within coordinates of 5° 28' 34.7160" N and 7° 1' 33.0708" E. Within these coordinates, Imo State University and Federal Medical Center can be located. Owerri is one of the most populous cities in southeast geopolitical zone of Nigeria and home to mostly the Igbo speaking tribe of Nigeria, who are majorly Christians though very few Pagans and Muslims are found within the city.

2.2 Study Population

Forty (40) young female subjects with regular menstrual cycle and 40 young female subjects with different kinds of menstrual irregularities, totally to 80 volunteer subjects were used in the present study. With letter of introduction, the needed approval and ethical clearance were secured. Each volunteer subject signed an informed consent form after the procedure and implications of the study were explained using a language the subject would understand. This study was conducted from August 2018 to December 2018. Young women below 18 years and above 30 years, those with medical history such as liver and kidney diseases, diabetes, hypertension, HIV, other chronic diseases, those that have conceived and were pregnant, were all excluded from the volunteers, along those that refused to sign the consent form. Young female with regular menstrual cycle served as control subjects while those with menstrual irregularities served as test subjects.

2.3 Blood Sample Collection and Analysis of Serum Sample

Five millilitres of venous blood was collected from each of the volunteer subjects using the standard clean venepuncture technique and dispensed into lithium heparin containers. The samples were spun at 4000 rpm for ten minutes to obtain the required plasma. The obtained plasma samples were stored at -20 °C until needed for further studies.

2.4 Estimation of Trace Elements

Trace elements such as zinc, copper, iron and selenium were estimated. Zinc was estimated with the modified colorimetric of Johnson and Eliassin [12]. Copper was estimated using

Centronic copper fluid kit. The method as described by Makino [13] was used for estimation of iron while selenium was estimated with whole blood following the method

2.5 Estimation of Sex Hormones

Sex hormones estimated were prolactin, estrogen and sex hormone binding globulin (SHBG). They were estimated using instructions on their kits (ELISA kits).

2.6 Estimation of Total Antioxidant Capacity

The total antioxidant capacity (TAC) was estimated using the instructions on the kit (TAC kits).

3.0 RESULTS AND DISCUSSION

Table 1: Trace elemental composition of the subjects.

Trace elements (µg/dL)	Test subjects	Control subjects	t_{cal}	P-Value
Zinc	6.61±0.41	6.44±0.22	0.633	p>0.05
Copper	0.81±0.02	0.84±0.07	-0.714	p>0.05
Iron	11.25±0.38	12.48±0.86	-1.7232	p>0.05
Selenium	0.17±0.02	0.15±0.09	0.3758	p>0.05

Results are mean and standard deviations of triplicate determinations.

The influence of some essential trace elements on reproduction has been reported. Menstrual irregularities could be as a result of the underlying diseases association with its manifestation. Zinc reduces prostaglandins, inflammation, and plays role in the immune-modulating protocol for endometriosis. According to Sylvie [14], the relations between zinc and menstruation remains elusive. However, the same author noted that zinc might help in the regulation of menstrual cycle and as well prevent adverse effects after menopause [14]. From Table 1, zinc ranged from 6.44 µg/dL in test subjects to 6.61 µg/dL in control subjects. It increased insignificantly (p>0.05) in test subjects when compared to the control subjects. Copper decreased insignificantly (p>0.05) in test subjects when compared to control subjects. The observation made on zinc and copper in the present study is in line with Mohammed *et al.*[15], who reported an insignificant decrease in mean values of copper and zinc in women with menstrual irregularities due to polycystic ovarian syndrome. The role of iron in blood formation cannot be overstated. The deficiency of iron from heavy menstrual periods is very common [16-21]. In women of childbearing age, heavy menstrual flow is the most frequent cause of iron deficiency anaemia [16, 21-23]. The role of selenium in the formation of special protein known as antioxidant has been noted [24]. Antioxidants are molecules opposed to stress in the body, and stress is one of the underlying causes of menstrual irregularities [24]. Iron and selenium in young women with menstrual irregularities decreased insignificantly (p>0.05) against the control subjects. A study made by Ceko *et al.* [25] demonstrates that selenium is increased in healthy large follicles of ovaries. The same authors noted that selenium assume basic part as antioxidant agent in the final phases of development of follicles.

Table 2: Sex hormonal level of the subjects.

Sex hormones	Test subjects	Control subjects	t_{cal}	P-Value
Estrogen (pg/mL)	227.80±2.80	361.71±3.17	-31.9207	p<0.05

Prolactin (ng/mL)	8.01±1.92	6.31±0.34	1.5101	p>0.05
SHBG (nmol/L)	40.21±3.78	59.38±1.61	-5.7094	p<0.05

Results are mean and standard deviations of triplicate determinations. SHBG: Sex hormone binding globulin.

Hormones are chemical messengers of the body [26]. Imbalance in hormones could result in significant effects on especially menstrual cycle in women [26]. In such condition, periods may occur more frequently or infrequently. Estrogen and SHBG decreased significantly (p<0.05) in test subjects when compared to control subjects. Prolactin level increased insignificantly (p>0.05) in test subjects against control subjects. Both estrogen and SHBG may have contributed to menstrual irregularities in the test subject in the present study.

Table 3: Total antioxidant capacity (mmol/L) level of the subjects.

Parameter	Test subjects	Control subjects	tcal	P-Value
Total antioxidant capacity	1.75±0.17	1.50±0.19	1.6983	p>0.05

Results are mean and standard deviations of triplicate determinations.

The ability of antioxidants to clean harmful free radicals in the blood and cells is known as total antioxidant capacity. It is often known with TAC as its acronym [27-28]. They are particularly relevant with irregular periods. Total antioxidant capacity of test subjects in this study increased insignificantly (p>0.05) when compared to those of the control subjects.

CONCLUSION

Trace elements in test subjects as observed in this study were insignificantly affected. However, estrogen and SHBG were significantly decreased against the control. The reduction in the estrogen and SHBG could be indication that menstrual irregularities of the test subjects may have been linked to hormonal imbalances.

REFERENCES

- [1]. Sachin BS, Vijaya MG, Kiran BD, Vinayak MG. Women's health issue: a brief overview on irregularities in menstruation. *International Journal of Novel Research and Development*. 2017; 2 (5): 140-145.
- [2]. Sheehan J, Medically reviewed by Lindsey Marcellin, Everyday Health, the Facts about Irregular Periods, 2010, <http://www.everydayhealth.com/pms/pms-article>.
- [3]. William CL, Menstrual Irregularities, Healthgrades Operating Company, 2013.
- [4]. Marilyn G, Women's Health Issue, Irregular Periods, www.marilynglenville-irregular-menstruation.com, 2012.
- [5]. Whitaker L, Critchley HOD. Abnormal uterine bleeding. *Best Practice & Research Clinical Obstetrics & Gynaecology*. 2016; 34, 54–65.
- [6]. Godfrey, EM, Folger, SG, Jeng G, Jamieson DJ, Curtis KM. Treatment of bleeding irregularities in women with copper-containing IUDs: A systematic review. *Contraception*. 2013; 87(5): 549–566. Retrieved August 2, 2016.
- [7]. Sweet MG, Schmidt-Dalton TA, Weiss PM, Madsen KP. Evaluation and management of abnormal uterine bleeding in premenopausal women. *American Family Physician*. 2012; 85: 35–43.
- [8]. Master-Hunter T, Heiman DL. Amenorrhea: evaluation and treatment. *American Family Physician* 2006; 73:1374–1382.
- [9]. French L. Dysmenorrhea. *American Family Physician*. 2005; 71, 285–291.
- [10]. Apgar BS, Kaufman AH, George-Nwogu U, Kittendorf A. Treatment of menorrhagia. *American Family Physician*. 2007; 75: 1813–1819.

- [11]. Hidioglou, M. Trace element deficiencies and fertility in ruminants; A review. *Journal of Dairy Science*.1979; 62 (8):1195-1206.
- [12]. Johnson D, Eliassin R. Evaluation of commercially available kits for determination of zinc. *International Journal of Andrology*. 1987; 10(2):435-440.
- [13]. Makino A. Evaluation of commercially available kit for the determination of iron. *Clinical Chemistry*.1998; 14(5):35-44.
- [14].Sylvie T. Zinc and the menstrual cycle. <https://healthyeating.sfgate.com/zinc-menstrual-cycle-10452.html>. 2018 (Accessed on 20/9/2020).
- [15]. Mohammed K, Abu Dabrh Am, Benkhadra K, Al Nofal A, Carranza Leon BG, Prokop LJ, Montori VM, Faubion SS and Murad MH. Oral vs transdermal estrogen therapy and vascular events. A systematic review and meta-analysis. *Journal of Clinical Endocrinology Metabolism*. 2015; 100(11):4012-4020.
- [16]. Ruth JH. Iron deficiency anemia from heavy menstrual periods. 2020; [https:// www. Very wellhealth .com/ heavy-menstrual-periods-iron-deficiency-anemia-5072751](https://www.verywellhealth.com/heavy-menstrual-periods-iron-deficiency-anemia-5072751)(Accessed ; July 5th 2020).
- [17]. Marret H, Fauconnier A, Chabbert-Buffet N, et al. Clinical practice guidelines on menorrhagia: management of abnormal uterine bleeding before menopause. *Eur J Obstet Gynecol Reprod Biol*. 2010;152(2):133-137. doi:10.1016/j.ejogrb.2010.07.016
- [18]. Bernardi LA, Ghant MS, Andrade C, Recht H, Marsh EE. The association between subjective assessment of menstrual bleeding and measures of iron deficiency anemia in premenopausal African-American women: a cross-sectional study. *BMC Womens Health*. 2016;16(1):50. doi:10.1186/s12905-016-0329-z
- [19]. Short MW, Domagalski JE. Iron deficiency anemia: evaluation and management. *Am Fam Physician*. 2013;87(2):98-104.
- [20]. Jimenez K, Kulnigg-Dabsch S, Gasche C. Management of iron deficiency anemia. *Gastroenterol Hepatol (N Y)*. 2015;11(4):241-250.
- [21]. Wouk N, Helton M. Abnormal uterine bleeding in premenopausal women. *Am Fam Physician*. 2019;99(7):435-443.
- [22]. Bayen S, Le Grand C, Bayen M, Richard F, Messaadi N. Anemia management in non-menopausal women in a primary care setting: a prospective evaluation of clinical practice. *BMC Fam Pract*. 2020;21(1):13. doi:10.1186/s12875-020-1086-5
- [23]. Di Spiezio Sardo A, Spinelli M, Zizolfi B, Nappi C. Ambulatory management of heavy menstrual bleeding. *Womens Health (Lond)*. 2016;12(1):35-43. doi:10.2217/whe.15.80
- [24]. Renate S, Edith L, Claudia MM, Christoph RS, Tanja Z, Philipp SW, Dirk P, Diane E H, Thomas M, Joseph L, Karl JL, Stefan B. Selenium supplementation improves antioxidant capacity in vitro and in vivo in patients with coronary artery disease the selenium therapy in coronary artery disease Patients (SETCAP) study. *Am Heart J*.2008; 156(6):1201.e1-11.
- [25]. Ceko MJ, Hummitzsch K, Hatzirodos N, Banner WM, Aitken JB, Harris HH. X-ray florescence imaging and other analysis identify selenium and GPXI as important in female reproductive function. *Metallomics*. 2014; 23(4):34-50.
- [26]. Jaime H. Can a Hormone Imbalance affect your menstrual cycle? Reviewed by Valinda Riggins Nwadike. <https://www.healthline.com/health/hormonal-imbalance-menstrual-cycle#symptoms> (Accessed on 20/09/2020).
- [27]. Prior RL, Cao G. In vivo total antioxidant capacity: comparison of different analytical methods. *Free Radic Biol Med* 1999;27:1173–81.
- [28]. Woodford FP, Whitehead TP. Is measuring serum antioxidant capacity clinically useful? *Ann Clin Biochem* 1998; 35:48–56.