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Abstract. Detection and monitoring of ovulation has long been practiced by women, particularly those participating in a natural family planning program. The urge of Indonesian Government for the society to participate in family planning program has caused the increasing demand for cheap and efficient method of self-test to predict fertile period in each menstrual cycle. The cheap, easy, and efficient method in predicting fertile period would be beneficial in encouraging more people to participate in natural family planning program. There are several low-cost methods can be used to detect the time of ovulation as an indication of fertile period, such as basal body temperature and cervical mucus. However, their interpretation is not always easy, particularly for young women. Calendar system and salivary ferning are two methods which have been perceived easy to be implemented and do not require special expertise, yet has been effective in promoting natural family planning practice. Calendar system is a method which requires a woman to keep track of menstrual cycle length using a calendar. Salivary ferning is the formation of crystal-like structure in woman's saliva. While single method may have weakness, the use of calendar system and salivary ferning simultaneously may provide a better insight into woman's fertile period. This study aimed to detect women's fertile period based on calendar system and salivary ferning. The result of observation showed that salivary ferning pattern found on day 11 and 16 of a menstrual cycle which is included in fertile days based on calendar system. The formation of salivary ferning pattern during fertile period as calculated through the calendar system support the potential use of calendar system and salivary ferning simultaneously as a double check to detect fertile period.

INTRODUCTION

Menstruation cycle is a naturally designed mechanism which affects female health and daily living quality for a span of approximately 35 to 40 years, from the beginning of adolescence to menopause [1]. Although the flow of blood during menstruation is the most noticeable event, the most important event is ovulation, which refers to the release of a mature egg from the ovary. Inside the ovary, there are multiple follicles grow under the influence of follicular stimulating hormone (FSH) which is secreted by the pituitary gland. These growing follicles secrete estrogen which subsequently inhibits FSH secretion. While adjacent follicles experience atresia due to the decreasing of FSH, a dominant follicle continues secreting estrogen. The high level of estrogen then triggers the release of luteinizing hormone (LH) from the pituitary gland, which will trigger the ovulation. After ovulation, the dominant follicle will be transformed into a corpus luteum, which release large amounts of estrogen and progesterone hormone. These hormones contribute to the further thickening and maintenance of the uterine lining

[2]. However, if fertilization does not occur, the corpus luteum will be degenerated and progesterone levels decline, thus leading to the disintegration of the uterine lining.

The disintegration of the uterine lining which contains a large amount of blood vessel is known as menstruation. The process occurs in monthly basis and lasts for approximately 3-7 days. One menstrual cycle is the range between the first day of a menstruation to the first day of a subsequent menstruation. A menstrual cycle normally lasts for 21-35 days. However, women generally have a menstrual cycle of 28 days [3,4]. Women understanding on menstrual cycle is beneficial for them to identify fertile period. The women's ability to detect fertile period rely on their ability to detect the fertility window, which begins approximately 3-5 days (sperm lifespan) before ovulation and continues to approximately 1-2 days (oocyte life span) after ovulation [1,5].

Detection and monitoring of ovulation has long been practiced by women, particularly those participating in a natural family planning program to plan or avoid pregnancy [6]. There are various methods can be used to detect the time of ovulation, such as ultrasonography, basal body temperature, and cervical mucus. Being expensive and inconvenient, ultrasonography technique is not broadly used for natural family planning participants. Monitoring ovulation by basal body temperature or cervical mucus has been helpful for natural family planning, but often misleading [7]. Women interested in determining their fertile period through basal body temperature technique are instructed to measure their oral, vaginal, or rectal temperature every day when wake up and before any activity is initiated. When the temperature recorded is above the threshold temperature, ovulation is suggested to have occurred. However, interpretation of basal body temperature is not always easy, as many factors may influence body temperature, including fever, alcohol, sleep disturbance, and change of waking time. Meanwhile, the fertility monitor through cervical mucus observations has shown to overestimates the fertile windows by almost 200%. Thus, it may add about 4 days more than necessary to the times of abstinence [8].

The urge of Indonesian Government for the society to participate in family planning program has caused the increasing demand for cheap and efficient method of self-test to predict fertile period in each menstrual cycle. The cheap, easy, and efficient method in predicting fertile period would be beneficial in encouraging more people to participate in family planning program. Calendar system and salivary ferning are two methods which has been perceived easy to be implemented and do not require special expertise, yet has been effective in promoting natural family planning practice. Calendar system is a method which requires a woman to keep track of menstrual cycle length using a calendar. Through calendar system, the fertility window can be determined between day 9 to 19 on each cycle. The use of simple calendar rhythm method has been found effective in determining fertility window [9]. Salivary ferning is the formation of crystal-like pattern of saliva which coincides with the female fertile period. The ferning is caused by the cyclical increases of NaCl under the influence of estrogen [7]. When crystal structure of a woman's saliva shows ferning pattern, then the woman is in the best period to get pregnant. Meanwhile, during infertile period, the crystal structure of the woman's saliva will only appear in dots or line pattern [10]. While single method may have weakness, the use of the two methods simultaneously may provide a more accurate detection on fertile period as it can be a double check for fertility period. Accordingly, this study aimed to implement fertility calendar and salivary ferning pattern to predict fertile period of young women aged 20 to 35 years.

RESEARCH METHOD

The study is a descriptive observational study which aimed to detect women's fertile period based on calendar system and salivary ferning pattern. The study was conducted in March-October 2017. The study population is women aged 20-30 years. The data were collected by observing the menstrual dates of participants for the last three months and reporting to the researchers. The subsequent steps were conducted by calculating the participants' fertile period based on their fertility calendar and observing the pattern of participants' salivary ferning under the microscope. The data collected from participants' fertility calendar were then analyzed through a table to calculate the average length of the students' menstrual cycle, to classify the menstrual cycles into regular and irregular pattern, and to predict the fertile period based on fertility calendar. Meanwhile, the data on salivary ferning pattern were analyzed by assessing the pictures of salivary crystal's pattern obtained from microscopic observation.

RESULTS AND DISSCUSSION

The study collected a total of 170 menstrual cycle records from all the participants. The menstrual cycle records were then subjected to the analysis of menstrual cycle length as shown in Figure 1.
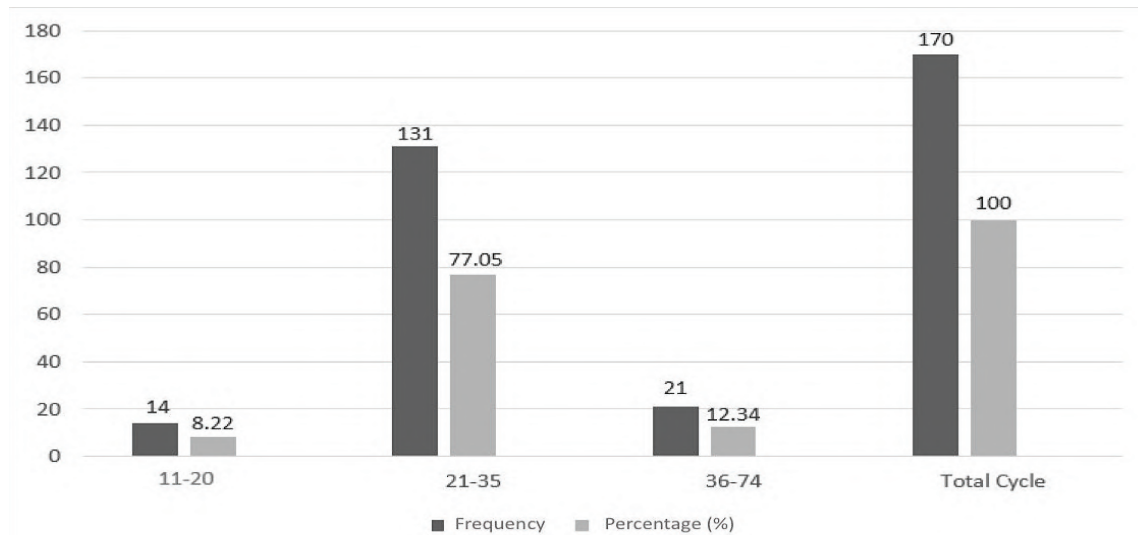
FIGURE 1. The average menstrual cycle length of women aged 20-30 years

The result of the study in Fig. 1 shows that the percentage of participants' menstrual cycle length range from 11 to 74 days, in which 77.05% of the participants has menstrual cycle length of 21-35 days. There were only 8.22% of participant with shorter period of 11-20 days, and only 12.34% of participants with longer period of 36-74 days.

The data shows that there are participants with too short (cycle length <21 days) and too long period of menstrual cycle (cycle length between 36 and 90 days). The former is known as polymenorrhoea and the latter is known as oligomenorrhoea. In normal population, polymenorrhoea and oligomenorrhoea occurs in high frequencies. Thus, intra-individual variation of more than 5 days should not be considered as the occurrence of certain disease in these women. A similar pattern of menstrual cycle length had been found in a study of adolescents in Surabaya city, in which the highest and the lowest percentage of menstrual cycle length is 20-30 days (65%) and 22 days (7.5%), respectively. It was found that the length of the cycle is negatively associated with the age. Reduced menstrual cycle length is reported to be positively associated with alcohol consumption as it changes the dynamics of hormone [10].

The salivary ferning analysis was conducted based on the intensity of ferning pattern of saliva shown under the microscope. There are three types of pattern shown in salivary analysis as shown in Figure 2. The classification of the ferning pattern is based on the intensity of crystal-like structure formed. The lowest, medium, and highest intensity of crystal-like structure formation would be scored by 1, 2, and 3, respectively.

(a) Score 1   (b) Score 2   (c) Score 3
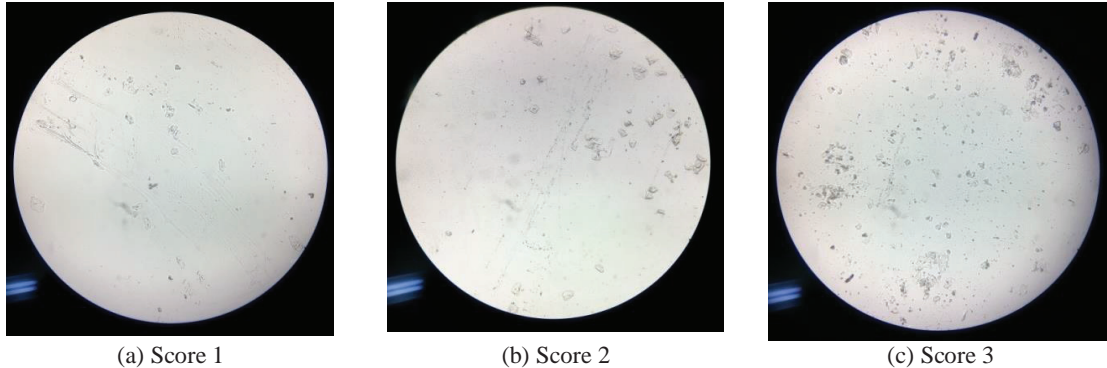
FIGURE 2. Salivary Ferning Pattern Day 11 to 16 after the First Day of Menstruation based on Fertility Calendar System

Score 1 was given to simple dot and line patterns, which indicate infertile period or no ovulation. Score 2 was given to small ferning patterns which show the formation of medium size of salivary crystals among spots and lines. The small ferning pattern indicates intermediate period, in which ovulation may occur in 3-4 days. Meanwhile, score 3 was given to strong ferning patterns which show a domination of crystal-like pattern. A strong ferning pattern indicates that ovulation is about to occur or already occurring. At this time, conception is possible as it is the most fertile period of a menstrual cycle.

Salivary ferning patterns with score 3 were obtained at day 11 and day 16 after the first day of menstruation. Score 3 means that the observed participants were in their fertile period. During fertile period, saliva anatomy undergoes a change known as Salivary Ferning. The term "ferning" refers to the form of salivary crystals which resemble a fern's leaf when observed under the microscope. Theoretically, when a woman's saliva shows ferning pattern, then the woman is in their best period to get pregnant. Saliva in human beings is produced mainly in the parotid, sublingual, and submaxillary glands. Saliva ferning depends principally on the electrolytes concentration (especially NaCl) and chemo-physical properties of the mucins it contains (cialic acid). During fertile period, there is a surge in the level of reproductive hormones, such as estrogen, LH, FSH, and prolactin. The high level of estrogen causes the increase the water content in mid-cycle and determine the most favorable condition, optimal proportion of water, and optimal amounts of salts and sialo-mucin [7]. Thus, affecting the formation of salivary ferning.

 The observation of salivary ferning patterns with score 3 on day 11 and 16 after the first day of menstruation in this study supports the suggestion of other researches that salivary ferning appears during fertile period. A study on women's menstrual cycle length showed that women's fertile period occurs on the first day of menstruation plus 19 days [4]**.** Another study which compared crystallization of saliva, mucus fluid, and abdominal fluid with ultrasound ovaries test found that 92% of saliva produced crystal-like patterns during the ovulation phase**.** The salivary ferning formed correlates with elevated levels of estradiol during fertile period [11].

The formation of salivary ferning pattern during fertile period as calculated through the calendar system support the potential use of calendar system and salivary ferning simultaneously as a double check to detect fertile period. The availability of various small hand-held microscope for the purpose of self-observing ferning patterns in saliva has made salivary ferning method more accessible for self-observation of fertile period.

CONCLUSION

The results of the study found that there is a correspondence between salivary ferning observation and calendar system characterized by the formation of saliva crystalline ferning pattern on the 11th and 16th day of the first day of menstruation.

ACKNOWLEDGMENTS

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