V. SUMMARY AND CONCLUSION

Menstrual cycle is an intimate interaction between chemical messengers. Menstruation is the cyclic orderly sloughing of the uterine lining in response to the interaction of hormones produced by the hypothalamus, pituitary and ovaries. It is a rhythmic fashion of cyclical events that takes place in every 28±3 days in the reproductive age of a woman. The menstrual cycle may be divided into 4 phases (viz.) preovulatory (or) follicular (or) proliferative, ovulatory, luteal (or) secretory and menstrual phase.

During the 20th century there was a dramatic fall in the age at menarche, widely attributed to improvements in nutrition and healthcare systems. There are many reports saying that girls have an earlier onset of menstruation than their mothers due to major nutritional or socio-economic advances occurred during the past 50 years.

A comparison of menarche ages is reported during the last 40 years from many regions of the world. If however, data from the same studies are analysed according to country, it is clear that menarcheal age has become lower in certain places not in others.

The age onset of menarche is multifactorial in nature. There is an interaction between nutritional, hormonal and environmental factors and socio-economic and anthropometric measures which decides the first and the succeeding cycles till the end of the reproductive age of a woman. Computer simulation models have been handled to understand, interpret and compare the influence of anthropometric and socio-economic criteria on the age of onset of menarche in college going girls in Nagercoil, Tamil Nadu, India.
The present study has revealed the causes for the early onset of menarche and the menstrual cycle related problems in the study subjects.

The main objectives are to gain:

1. directly a better understanding about the causes for the onset of menarche in pre-teen and teen ages in girls.
2. indirectly an understanding about the role of various biochemicals and its related events in menstrual cycles in girls.

**Major findings of the study**

1. The mean age of the population is 18.89 ±1.57 yrs.
2. The mean menarche age of the subjects is 13.14 ± 1.18 yrs, while it is 14.48 ± 1.4 yrs in their mothers.
3. The lowest and the highest menarche age are 10, 17 yrs respectively.
4. It is well known that 34.7% girls are pre-teen menarche subjects (10-12 yrs) and the remaining 65.3% subjects’ attained menarche in their teen ages (i.e.) 13 – 17 yrs.
5. In the teen age menarche group 32.2% subjects show their first menstrual flow at the age of 13 yrs and rest 33.1% cases reached menarche at the age of 14 – 17 yrs.
6. The study also reveals that 7.86% study subjects’ mothers attained menarche in their pre-teen age(10 -12 yrs), 15.86% at the age of 13 yrs and 76.28% mothers at the age of 14 – 19 yrs.
7. The lowest menarche age of the subjects’ is 10 yrs and the highest age is 17 yrs, while it is 10 yrs and 19 yrs respectively in their mothers.
8. A positive association between menarche ages of the mothers and the subjects is very well understood from the study.
9. A positive impact of various factors such as economic status, food habits, habitation, blood groups, BMI, WHR and the duration of cycles on the onset of menarche in girls are traced out.

10. It is well known from the study that there is no impact on the age at menarche and the nature (irregular/ regular) of the menstrual cycles.

11. The study also confirms that the study subjects’ and their mothers’ menstrual cycles are totally independent of each other. It is true in subjects vs their first, second and third sisters also.

12. The study shows that there is no association between the subjects’ menarche ages and the nature of menstrual cycles (regular or irregular cycles).

13. It is well known from the study that the subjects’ and their mothers’ menstrual cycle types (regular /irregular) are totally independent in nature.

14. The study also indicates the independent nature of menstrual cycle types in the subjects’ and their sisters (1st, 2nd and 3rd).

15. The independent nature of menarche ages in the subjects and their mothers are well documented in the study.

16. The menstrual cycle related PMS (13.3%) and PMDD (23.24%) and its prevalence in teenage menarche subjects are quite clear from the study.

17. A very low incidence of menstrual flow disorders (6.46%) such as menorrhagia, hypermenorrhagia, dysmenorrhea, oligomenorrhea, polymenorrhea, amenorrhea, and spotting is observed in the study.

18. A moderate level of incidence (31.66%) of menstrual cycle related ailments is documented in the present study.

19. The various levels of enhancement and derangement of specific biochemical substances related to menstrual cycles and their role
in different phases of the cycles are clearly understood from the study.

20. A slow, steady increase and sudden surge of testosterone, lutinising hormone, estrogen and follicle stimulating hormone during ovulation and plunges during premenstrual period is noticed. The hormone progesterone peaks around the third week (i.e.) premenstrual period and declines during the menstrual period, which is irrespective of the menarche age of the subjects.

21. Estrogen and serotonin, the two critical vital components are considered as the body’s own antidepressants and mood stabilizers rise during the ovulatory phase and declines thereafter.

22. It is found that thyroid hormones (i.e.) TSH, fT3 and fT4 are within the range in different phases of the cycles.

23. HDL cholesterol peaks around the ovulatory phase, while LDL, total and triglycerides are more in follicular phase and lower in luteal phase.

24. It is clear that the levels of lead in blood serum increases steadily and declines after menstruation.

25. It is evident from the study that the highest level of IgG is noticed during menstrual phase and the lowest level is detected in the preovulatory phase.

26. The study also confirmed the highest level of ferritin and Hb are seen during the luteal phase and drops in the menstrual phase.

27. The study also shows that, irrespective of the phase of the cycle, the prothrombin time is found within the range.

28. The study also confirms that there is no change in total blood cells count and WBC count whereas reduction of RBCs is found during menses and an elevated ESR during the entire cycle.
29. The study further reveals a low level of serum sodium in the luteal phase than menstrual and follicular phase, high level of potassium in luteal phase than menstrual and follicular phase, high level of calcium in follicular phase than menstrual and luteal phase, and low level of magnesium in menstrual and follicular phase.

30. The study also indicates that there are no significant changes in the levels of enzymes such as ACP, ALP and LDH throughout this cycle.

31. The study also pinpoints that, irrespective of the menarche ages of the subjects there is no change in serum Ca-125 in the entire cycle.

In order to validate our analysis the collected data is examined via various statistical models using R – open source software used by statisticians to simulate the analysis. The following list of models / tests are used to evaluate the data

a) Ordinary Least Square Regression Model – One of the most common models used to draw the best line of fit between the dependent (response variable) and independent variables.

b) Durbin Watson Test – Used to determine the auto correlation of the residuals (prediction errors) from the regression analysis

c) GVLMA Tests – Global Validation of Linear Model Assumptions test help us to validate the assumptions based on Skewnees, Kurtosis etc..

d) Generalized Linear Mixed Model – Ordinary Linear Model will consider only Fixed effects, GLMM is an extension of Linear model which also includes random effects in the simulation
In conclusion menstrual cycle is a natural biological event which is unavoidable to the normal women and is the vital cycle for the continuation of races. The age of onset of menarche is not fixed and varies from region to region, population to population, individual to individual and changes with time. Eventhough it is some extent influenced by family history (heredity), body built and season. It seems it is more susceptible to certain socio-economic influences such as nutrition, habitation (life style)and disorders like diabetes, obesity etc. This monthly mega event in the reproductive age of women is associated with certain abnormalities which are under the control of endocrine, neural, genetic, environmental mechanisms and so on.

The study recommends the following things to win over the menstrual cycle related abnormalities:-

1. **To the parents:** Do not make obese children. Obesity is the mother of all future health risks including early menarche. Do not forget early menarche and late menopause favours breast cancer.

2. **To the individuals:** Do not be a victim of menstrual cycle disorders including PMS and PMDD. Try to over come with these life centered problems with better lifestyle and proper medicare. For a smooth monthly cycle one should keep the mind and body fit. Try to live with nature and avoid unnatural items including food to tackle this monthly miracle. Detect apt damage control modes and try to evade or at least over come from the cycle related menaces.

3. **To the authorities:** Try to introduce a standard protocol for various blood analyses especially fix a proper time for drawing blood in individual menstrual phases to enable uniform conclusion about the menstrual cycle biomarkers.
Nothing is impossible under the sun and above the soil. With a healthy body, firm and clear mind we can surpass any amount of problems. It is no doubt that planned life, proper medicare and holistic environment will drive the human menaces far away from the earth.