



# IMPACT OF DEHYDRATION DURING MENSTRUATION

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## ABSTRACT

Dehydration is a common phenomenon observed in females, especially during the menstrual cycle, a monthly occurrence. Hormonal fluctuations and significant loss of blood and other factors, cause M.S.P.M.S. (premenstrual symptoms). The severity of discomfort observed by females during the menstrual phase is primarily caused by dehydration which females ignore. Ideally, the female body tends to produce sufficient fluids during the follicular phase of the menstrual cycle to compensate for the loss of fluids during the menstrual period. However, if a woman doesn't consume adequate water, her body may not be able to make up for the loss. This leads to dehydration and further health problems. The current study attempted to understand the impact and awareness of dehydration during the menstrual cycle. The study included two parts: Part 1 was a case study observing and monitoring 80 females from a varied age group of 15-45 years for three months, which further divides into control and experimental, the study included questions about the female's dietary intake and menstruation-related factors. The present research indicated that women suffer from severe dehydration during the menstrual cycle, especially during the bleeding phase, due to low water consumption and are unaware of the same. The second part of the study involved a general survey circulated among males and females irrespective of age groups. It can be concluded that males are unaware of the symptoms that females undergo during menstruation and are also ignorant about the signs of dehydration. Similarly, it was found that women undergo dehydration but are unmindful of the same. The present study will help create awareness about dehydration so that appropriate measures can be carried out.

**KEYWORDS:** Menstrual cycle, Dehydration, P.M.S., hormones.

## INTRODUCTION

The human body undergoes various physiological cycles, one of which occurs in females only is menstruation. The shedding of the uterine lining marks the start of a new menstrual cycle known as menstruation. This process occurs approximately once a month, 28 days to be precise, in women of reproductive age group, proving that pregnancy has not occurred (Dhanorkar *et al.*, 2023). In humans, the menstrual cycle is shown by the vaginal bleeding caused by the shedding of the uterine lining, which is its most

noticeable characteristic. (Thiyagarajan *et al.*, 2022).

During menstruation, the female body undergoes many physiological changes causing M.S.P.M.S. (premenstrual syndrome), due to dehydration. When the body's water loss is more than the body gaining water is termed dehydration (Popkin *et al.*, 2010). The factors which cause dehydration are excessive sweating, diuretics, low water consumption, and higher body temperature than usual. A state of dehydration occurs with excess loss of total body water and is linked with electrolyte abnormalities, particularly

dysmenorrhea (Menstrual cramps) (Sharkawy *et al.*, 2015). Even though dehydration causes the loss of electrolytes, significantly sodium, and potassium, and due to the loss of water, the concentration of sodium in the blood rises (Lewis III, 2022).

Water retention, referred to as bloating, is a countereffect due to dehydration during menstruation (Hooper *et al.*, 2015). Progesterone increases the hypothalamic temperature, so body temperature increases during the luteal phase, significantly resulting in dehydration (Thiyagarajan *et al.*, 2022). During menstruation, blood is lost, and rapid hormonal shifts occur simultaneously. The hormonal fluctuations that control the menstrual cycle can change how the body uses water, resulting in fluid retention, which is not avoidable most of the time (Al-Qarawi *et al.*, 1997).

The amount of blood flow can be impacted by various factors, including medications, the thickness of the endometrium, blood disorders, etc. This blood loss leads to dehydration, as blood is composed of electrolytes and water (Thiyagarajan *et al.*, 2022). Weakness, a symptom of M.S.P.M.S. during menstruation, is usually caused by dehydration due to the loss of blood and water that occur during one's period (Al-Qarawi *et al.*, 1997).

Everyone goes through thirst occasionally, but this thirst increases in the normal range when females undergo menstruation. Cravings cause an individual to consume food items that are less hydrating in nature and instead more sweet and sour food items that are satisfying to the palate. These factors can cause an increase in dehydration during the menstrual cycle in women.

During the early follicular phase of the menstrual cycle, the estrogen level in the body shoots up, causing AVP (arginine vasopressin) synthesis to compensate for the water loss caused by this hormonal change and resulting in fluid retention. Bloating, the most common problem that females face during menstruation (bleeding phase), is caused due to water loss (dehydration).

Considering the late luteal phase (the week before menstruation), progesterone, and estrogen concentration increase, causing AVP synthesis to counter dehydration. Another offset of water loss during menstruation is aldosterone synthesis stimulated by loss of blood pressure (figure 1). The food and fluid intake during menstruation can cause fluctuation in the water level in the body, and this fluctuation (in a negative way) can cause different stages of dehydration. Depending on the amount of fluid you are missing from the body, one may experience mild, moderate, or severe dehydration. The stages of dehydration are as follows  
FIRST stage: dark urine, dry mouth, puffy and swollen eyes, thirst, fatigue, dizziness & headache. Advanced stage: very low or no urine output, shallow blood pressure, rapid heartbeat, fever & confusion. Final stage: coma, seizure, shock, vomiting & diarrhea.

The M.S.P.M.S. encountered by women is caused due to dehydration because of hormonal fluctuations which most females are unaware of. The symptoms include mood swings, bloating, headache, and poor concentration which are caused by dehydration. The purpose of this research is to understand the impact of dehydration during menstruation in females and to gain knowledge about the various associated with the menstrual cycle. The

present study also tried to understand the rate of awareness of dehydration among people especially during menstruation.

### **MATERIALS / METHODOLOGY**

The methodology is separated into two parts as follows:

- A) Case Study
- B) Google Survey

#### **A) Case Study**

A case study was conducted with the help of a standard questionnaire prepared for the research. The study was divided into two groups of females namely control and experimental. The total number of females used was 80 (age group 15 to 45 years). The control group and experimental group were constantly monitored for a period of three months. Both groups were provided with the below questionnaire. The control group and experimental group consisted of 40 females each respectively. The water intake of both groups was monitored for the first month. However, from the second month onwards the experimental group was asked to increase their water intake by 500 ml to 1L more than the regular intake respectively. The control group was not disturbed. The water intake of each female was observed using water bottles and various physiological factors such as heart rate, physical exercise, etc was also considered. The use of a fit band or smartwatch was opted for the same.

The questionnaire was divided into three parameters as given below:

i) **General information** which consisted of questions like age, weight, height, occupation, etc of the female.

- What is your age?
- What is your weight?
- What is your height?
- What is your occupation? If you are a student, select others.

ii) **Lifestyle** habits which contain questions about their diet and fluid intake, physiological exercise (sedentary or moving), mental state, and sleep cycle.

- What was your diet throughout the day (breakfast, lunch, and dinner)?
- What was your water consumption today? (Using measuring water bottles).
- Did you suffer from dehydration today if yes which level?
- Did you perform any physical exercise? if yes elaborate on each of them (using the fit band).
- If any exercise was performed today, mention the type and duration of the same.
- How much was your movement for today?
- Did you suffer through any stress today, physical or emotional?
- How many hours did you sleep today?
- Do you suffer from any menstrual-related issues like PCOD/PCOS, PMS, or others? if yes mention
- Are you menstruating?
- If you suffered from menstrual cramps which medications did you consume?
- Do you suffer from PMS (a premenstrual syndrome is physical and emotional symptoms experienced days before a women's period. this results in mood swings, craving for food, and depression)
- What is the colour of your flow when your flow is the heaviest?
- How many days do you menstruate?
- Was your menstruation on time if not how early or late?

iii) **Physiological variation** occurring due to the individual's activity included

questions regarding medications consumed (antidiuretics, antidepressants, antibiotics, etc), any illness or diseases like diabetes, menopause, and other menstrual-related issues too.

- Did you suffer from any kind of physical, mental, or emotional discomfort today? If yes how severe was it?
- Did you consume any medications? if yes do mention it.
- Do you have any condition like diabetes or other if yes please mention the condition and medication consumed for the same.
- Did you consume any kind of alcohol, done smoking, or other, if yes do mention it.

## B) Google Survey

Two google surveys were created for the current research work. One survey considered only females and included questions about their daily water intake, dehydration level, dietary intake, stress levels, and menstrual flow and their knowledge regarding M.S.P.M.S. (premenstrual syndrome), PCOD/PCOS (polycystic ovarian disease/ syndrome), menopause, hormonal changes, etc.

- What is your BMI?
- How many liters of water do you normally consume in a day?
- Do you suffer from dehydration regularly
- How many hours did you sleep do you have in a day?
- Do you suffer from any menstrual-related issues like PCOD/PCOS, PMS, or others? if yes mention
- If you suffered from menstrual cramps, how severe were they?
- Do you suffer from PMS (a premenstrual syndrome is physical

and emotional symptoms experienced days before a women's period. this results in mood swings, craving for food, and depression)

- What is the color of your flow when your flow is the heaviest?
- How many days do you menstruate?
- Was your menstruation on time if not how early or late?
- Did you suffer from any kind of physical, mental, or emotional discomfort today?
- Did you consume any medications? if yes do mention it.
- Do you have any condition like diabetes or other if yes please mention the condition and medication consumed for the same.
- Did you consume any kind of alcohol, smoking, or other, if yes do mention it.

The second survey focussed on males to understand their awareness about the menstrual cycle in females and various factors associated with it. Questions are asked about terms like M.S.P.M.S. (premenstrual syndrome), PCOD/PCOS (polycystic ovarian disease/ syndrome), menopause, and menarche.

This will give us an idea about the knowledge and awareness among men regarding the aspects of menstruation and dehydration hand in hand. Information of the same was provided in the survey and below questions were asked.

- How much information do you think you have about menstruation and its effects on other physiological factors?
- Was this survey helpful in any way regarding the knowledge about menstruation
- If yes, how helpful was it?

The survey was circulated randomly throughout the country. The problems arising due to dehydration during menstruation are mentioned for awareness in the respective surveys

### **Statistical Analysis**

A T test was performed to evaluate the group difference between control and experimental.

## **OBSERVATIONS & RESULTS**

The observation and results obtained are divided into three parts as follows.

### **1) Case study:**

The lifestyle and water intake in all forms of the women of both the groups (control and experimental) were monitored for the first month of the study without any interference. From the case study it can be observed that in general as females age they exhibit increased levels of dehydration especially as they proceed toward menopause. The females of the age group of 15 to 25 revealed an escalated state of dehydration caused due to their diet and lifestyle (sleep cycle, exercise) in addition to the menstrual cycle.

The factor like mental stress get worse due to dehydration and the effects of PMS in turn also increases hence the factors do contribute but during menstruation dehydrations causes severe effects as the observation shows that females suffering from mental stress or physical exercise are 24.6% fewer but the dehydration level is mostly the same in during menstruation i.e. 75.4 %. Stress and other factors which cause dehydration during menstruation and normal days are very few as given in the figure 2, 69 % of females did not suffer from stress whereas 31% suffered from stress but 60 % in the control group, among all females underwent through dehydration. It can be said from the found observations

that the diet plays an important role in keeping the body hydrated specifically during menstruation. In the control group it was observed that during the three months of study the women consumed on an average 2.5 litres of water and suffered from dehydration. They exhibited signs of being dehydrated and also suffered through PMS. Similar results were seen in the first month study of the experimental group.

However from the second month onwards the experiment group females consciously consumed 500 ml to 1L of water more than their daily average. The increase in water intake helps in reducing PMS symptoms and also the signs of dehydration were reduced or negligible. Higher the water intake better health conditions were observed throughout and especially during the menstruation period. The same pattern was observed in the third month of study of the experimental group females.

The factors like stress level, diet, exercise, sleep and medical ailments, etc were also considered. They did have some role to play in dehydrating the individual. However if the female was consuming an adequate amount of water she was able to deal with PMS and other factors of stress, diet, sleep etc in a better way.

Dehydration is observed the most during their late luteal phase and menstrual phase as compared to other times of the month, other contributing factors like having an imbalance diet consumption of diuretics, suffering from conditions like diabetes and PCOD/PCOS and menopause cause the severe level of dehydration altogether. From the observation we can conclude that females suffer higher degrees of dehydration and other menstrual related problems when their water intake is less than 2.5 litres and other factors like stress,

sleep cycle, medication, exercise, eating habits and lifestyle can further worsen the symptoms.

#### **Statistic analysis:**

The parameter considered for the t test was average water intake by females.

The T test showed that there is no significant difference between the water intake of the control and the first month of the experimental group (P value 0.8049).

The T test conducted for the second and third month of experimental and control groups showed statistical significance with the P value of 0.0001 respectively.

Similarly T test was carried out between the first month of the experimental group and second- third month of the experimental group. It showed statistical significance with the P value of 0.0001.

#### **2) Google survey A: Females**

**From the survey it can be said that** the females suffering from disorders like hypertension, hypotension, hypoglycaemia, and hyperglycemia show drastic changes in the fluid and electrolyte levels in the body during menstruation, and the ones who have approached menopause to show a low level of dehydration in their body. It was observed that females who were on medication suffered from dehydration highly as the medication caused a physiological change in the electrolyte and water levels in the body. Females drinking more water and having a balanced diet are not suffering from dehydration, constipation, and other symptoms of dehydration and might have a heavy flow and less fatigue. Due to the lifestyle, the females have suffered through dehydration more frequently, and this dehydration also causes adverse effects on the physiology of the menstrual cycle.

25.7%, 2.9%, and 1.4% of females suffer from the first, advanced, and final stages of

dehydration daily respectively & 70% didn't suffer from dehydration. 54.3%, 7.1%, and 1.4% of females suffer from the first, advanced, and final stages of dehydration during menstruating respectively, and 37.1% of females don't suffer from dehydration during menstruating (figure 4).

Regularly, 25.7 % of females suffer from dehydration, whereas during menstruation, this percentage increases to 53.4%. Thus, it shows that menstruation causes dehydration.

The literacy rate amongst the men about dehydration w.r.t. menstruation is 78.3 %. The other men who don't know or know very little about it are 21.70%. The awareness among men w.r.t dehydration during menstruation is that on a scale of 1 to 10, with 10 being the most aware most people chose 8 and 7.

Depending on the colour of blood flow during the menstrual phase, the water level can be found in people with crimson red & thick texture highest is 42.9%, and this color appears in excessive heat, indicating a low water level in the blood. In contrast, the population showing dark red with clots has a population of 37.1% which indicates the average value of no low water level.

#### **3) Google survey B: Male**

Among the male population it shows that more than 50% of males were aware of the terms related to the menstrual cycle. This survey was also helpful in causing awareness in 88.3% of males regarding the dehydration caused during menstruation and its causes.

### **DISCUSSION**

The current research discusses the possibility of dehydration in human females during menstruation. It is an aid to

understand the causes and possible effects of dehydration.

The current study showed that females tend to suffer from various stages of dehydration during their menstruation. Factors like stress, medications, exercise, sleep cycle, etc also contribute to dehydrating the human body, however the severity of dehydration depends on how hydrated the body is. Drinking enough water can compensate for the water loss and in turn reduces the effects of negative physiological changes like menstrual cramp, decreased concentration, etc.

The current study revealed data that shows 8/10 females suffer M.S.P.M.S. prior to the menstrual phase. The effects can vary from mood swings to cravings for food and also include but do not restrict symptoms like headache, body ache, constipation etc.. A similar study was performed by Sivakami *et al.*, (2019) in three states of India to mark and improve the emotional, mental, and physical problems commonly occurring in females during menstruation which causes absentee in school where most symptoms observed were caused by dehydration.

Al-Qarawi *et al.*, (1997) conducted research that states that absorption of water and electrolytes from the kidneys and the gut is under the influence of plasma AVP and aldosterone and fluid withdrawal from the tissues to maintain average blood volume is the first response to the disturbance in water balance, this approves the results obtained by the current study where 60 % females suffer through water loss during dehydration as water retention occurring as a countereffect of the water loss observed in females due to hormonal fluctuations throughout the menstrual cycle. The same study supports the results of the case study where the control group of three months, the first month of the

experiment, the second month, third month showed 60%, 61%, 53.6%, and 38 % suffered from dehydration respectively.

Research conducted by Shazia Iqbal *et al.*, (2021) in Saudi Arabia proved that 6.6% reported prevention of menses due to anxiety and 23.7% reported that anxiety affects the duration of menses similar results from the case study of the current study were obtained which showed 31 %, 30.1%, 28.8%, 32% female suffered through stress and caused irregular periods of the control group, first experimental, second experimental and third experimental group respectively.

Current research showed that symptoms like menstrual cramps, decreased concentration, etc., are severely seen during menstruation due to the lifestyle and also are caused by dehydration, resulting in 50% of females having irregular periods. This study matches the research done by Trangmar *et al.*, (2019), stating the impact of dehydration on physiological function depends on the functional demand evoked by environmental stress.

The research done by Thiyagarajan *et al.*, (2022) showed that the hormonal fluctuations occurring during menstruation cause water retention, which encourages the results from the current study where 7.1% of females suffer from bloating caused by the same.

The current study, where 78.6% of females suffer from menstrual cramps and other menstruation-related problems, is supported by Omidvar *et al.*, (2018), where 66.8% of females had dysmenorrhea.

The research which was undertaken by Dhanorkar *et al.*, (2023), stated that iron and water loss cause weakness in the body, which supports the results from the current study where the females from the experimental group of the first, second,

third month where 23%, 10.4%, 8.2% females consume antispasmodic medication to aid dysmenorrhea stating that weakness is caused due by blood loss which in turn causes iron deficiency and M.S.P.M.S. which is caused by loss of water and hormonal changes.

The current study shows 17.1% and 23.2% of females perform exercise during menstruation and on standard days, respectively. These results are similar to the study done by Jessica 'O'Neill *et al.*, (2016), suggesting that during exercise in the dehydrated state, sweat rate is reduced thereby enhancing thermoregulatory and cardiovascular demands during exercise in a hot dry environment.

The study was done by Baker *et al.*, (1999) where menstrual cramps cause a short sleep cycle or disturbed sleep cycle which supports the results of the current study where in the control group 45.6 % of females who have less than 7 hr sleep a day suffer from menstrual pain.

A study was done in Iraq by token *et al.*, (2021), which suggested that females having increased water intake suffered through less intensity of menstrual cramps this study strongly agrees with the work done in the current study where females who were hydrated enough 'didn't suffer through dysmenorrhea.

In September 2018, the Gynecologic Health and Disease Branch of the Eunice Kennedy Shriver National Institute of Child Health and Human Development convened a 2-day meeting, "Menstruation: Science and Society," with an aim to "identify gaps and opportunities in menstruation science and to raise awareness of the need for more research in this field" (Critchley *et al.*, 2020) and menstruation-related topic were put forth in the U.S. school of public health in their syllabus to create awareness

(Sommer *et al.*, 2020). Similar work concerning awareness among all individuals, both females, and males, is done here where menstruation-related problems like P.M.S., irregular periods (caused by various factors including adenomyosis), heavy bleeding, etc. were conveyed by the google survey method.

A study conducted by William *et al.*, (2020) showed that at high temperatures and microclimate variability, organisms (frogs) suffer from water; this helped us understand the work done in this research. It stated that the mechanism of dehydration occurs due to environmental factors like humidity, temperature, and air pollution (lifestyle habits and climatic conditions) among females. This supports the results found by the current research where water loss occurs in females due to climatic conditions and lifestyle habits are concerned.

Females, during their menstrual cycle, suffer predominantly from dehydration, and their diet is responsible for the level of dehydration they suffer through. What exactly happens in the body during dehydration will be known. E.g., During menstruation, the estrogen level in the body increases, causing an increase in the aldosterone level that will result in water retention and fluctuation in the electrolytes like Na<sup>+</sup> and k<sup>+</sup> balance.

Through this research, we can conclude the improvement needed in lifestyle and eating habits w.r.t the climate people live in. dehydration is a small aspect in all physiology. Still, plays a crucial role in healthy working in humans. Drinking water at frequent intervals, and consuming liquid high in zinc and vitamin C.

During menstruation, females tend to crave junk food that is highly salty, spicy, or sweet which causes severe dehydration and negative health effects. Nowadays, people



tend to eat packaged food, and the lifestyle people have right now causes significant health problems. Dehydration is a contributing factor in this severity, so healthy drinks and a balanced diet with regular exercise during normal and menstruation can majorly reduce dehydration and, therefore, avoid the problems caused by it.

From the present study it can be said that females who don't suffer or suffer on a small scale from dehydration on a regular basis suffer more severely from dehydration during menstruation. The current research observed that females tend to dehydrate during the menstrual cycle because of the loss of water and fluctuations in estrogen and aldosterone levels. Physiologically speaking, these changes during the menstrual phase cause water retention, and this shows symptoms of dehydration.

The main problem with the high severity of dehydration is because of the female's lifestyle. The females in the age group of 15 to 25 are the ones to show a high level of dehydration as their lifestyles are influenced by factors like inadequate sleep, increased stress levels, insufficient water and electrolytes intake and consuming unhealthy food that is salty, sweet, and spicy.

Also insufficient absorption of essential nutrients required by the body and cravings during menstruation are the main factors causing advanced stages of dehydration. From the google survey conducted it can be concluded that most females, as well as males, are unaware of the fact that dehydration causes M.S.P.M.S. (a week before the period) and dysmenorrhea (while menstruating). Awareness among males and also females is required. The present study helped do so to a small extent.

## ACKNOWLEDGEMENT

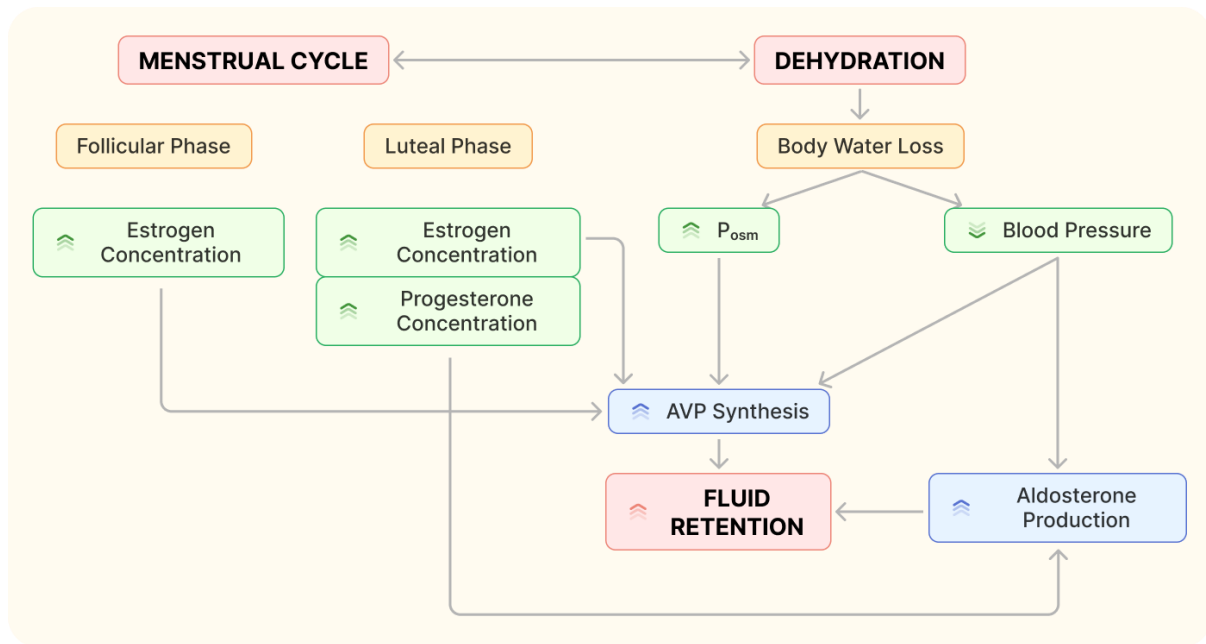
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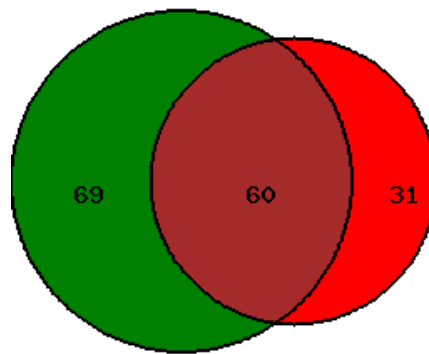
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**Fig1:** Relation of menstruation and dehydration

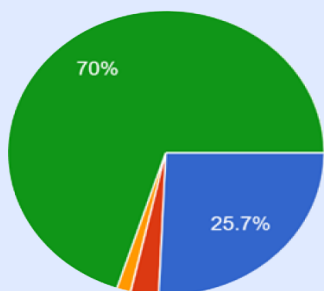


**Fig 2:** percentage of females suffering from stress and dehydration.

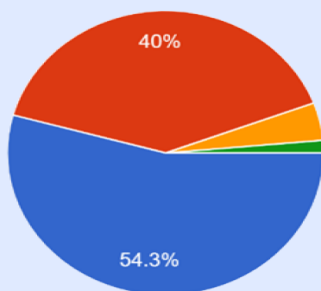
Questions Groups	did you suffer from PMS	how many hour did you sleep	Did you suffer from dehydration (menstruation days)	Did you suffer from dehydration (normal days)	Medication consumption	Stress
	NO YES	< 7 hr 7-8 hr > 8 hr	First Advance Final Not applicable	First Advance Final Not applicable	NO YES	NO YES
Control group monitoring	12.6% NO 87.4% YES	5.1% < 7 hr 49.3% 7-8 hr 45.6% > 8 hr	40% First 37.1% Advance 1.6% Final 21.3% Not applicable	60.2% First 23.7% Advance 15% Final 1.1% Not applicable	3.8% NO 96.2% YES	31% NO 69% YES
Experimental first month monitoring	15.8% NO 84.2% YES	4.8% < 7 hr 56.2% 7-8 hr 39% > 8 hr	39% First 37% Advance 1.2% Final 22.8% Not applicable	59.7% First 25.2% Advance 14.2% Final 0.9% Not applicable	1.8% NO 98.2% YES	30.1% NO 69.9% YES
Experimental second month 2.5-3 L/day	20.7% NO 79.3% YES	6.2% < 7 hr 53.3% 7-8 hr 40.5% > 8 hr	46.4% First 42.6% Advance 10.8% Final Not applicable	64.8% First 22.8% Advance 12% Final 0.4% Not applicable	2.1% NO 97.9% YES	28.8% NO 71.2% YES
Experimental third month 3-3.5 L/day	19.9% NO 80.1% YES	4.2% < 7 hr 53% 7-8 hr 42.8% > 8 hr	62% First 36.8% Advance 1.2% Final Not applicable	65.2% First 24.5% Advance 10.3% Final Not applicable	2% NO 98% YES	32% NO 68% YES

**Figure 3:** Case study results

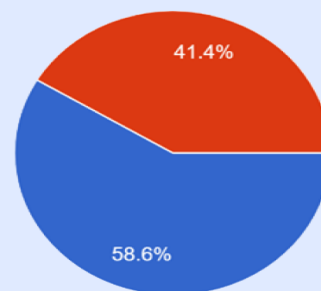
**FEMALES:** 78.6% OF FEMALES SUFFER FROM DISCOMFORT DURING MENSTRUATION AND 21.4 % DON'T.



**DURING NORMAL DAYS** 25.7%, 2.9%, 1.4% SUFFER FROM THE FIRST, ADVANCED, AND FINAL STAGE OF DEHYDRATION RESPECTIVELY & 70% DIDN'T SUFFER .



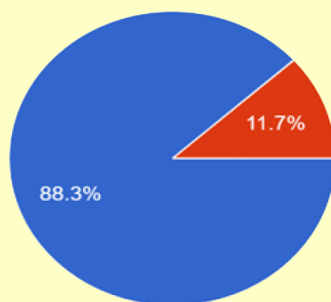
**DURING MENSTRUATION** 54.3%, 3.5%, 2.2% SUFFER FROM THE FIRST, ADVANCED, AND FINAL STAGE OF DEHYDRATION RESPECTIVELY & 40% DIDN'T SUFFER.



**58.6% OF FEMALES** SUFFER FROM PMS WHEREAS 41.4 % DON'T.

**Figure 4:** Dehydration level during normal and bleeding phase.

**MALES:** 65% OF MALES WERE AWARE OF THE TERM PMS AND 35% WERE NOT.



**88.3 % OF MALES** BENEFITTED FROM THIS SURVEY AND 11.7 % WERE NOT.

**Figure 5:** male awareness about dehydration during menstruation.