Project Report on

Development of Beetroot Juice for Preventing Menstrual Cramps

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LETTER OF TRANSMITTAL

Date: 17.02.2022

The Head
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Subject: Submission of Project Report

It is a great pleasure and honor for me to have the opportunity to submit Project report as a part of the Nutrition and Food Engineering (NFE) program curriculum. I have prepared this report based on the acquired taste knowledge during my research period in Food Processing Laboratory of Nutrition and Food Engineering (NFE) Department and Bangladesh Reference Institute for Chemical Measurements (BRiCM). This Report is based on, "Development of Beetroot Juice for Preventing Menstrual Cramps".

I, therefore, would like to submit this report for your consideration to represent my dissertation. Your thoughtful advice and critic will motivate me to plan better in the future.

Sincerely yours'

Umme Habiba Tanny

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LETTER OF AUTHORIZATION

Date: 17.02.2022

The Head
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Subject: Declaration regarding the validity of the Project Report.

This is my truthful declaration that the "Development of Beetroot Juice for Preventing Menstrual Cramps" have been prepared without copying any thesis report previously made by any other students.

I also express my reliably confirmation in support to the fact that the said report has neither been used before to fulfill my other course related nor it will be submitted to any other person in future.

Sincerely yours'

Umme Habiba Tanny

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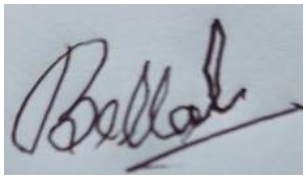
LETTER OF RECOMANDATION

This is certified that the thesis report entitled "Development of Beetroot Juice for Preventing Menstrual Cramps" at our department Food Processing Laboratory and BRiCM Laboratory, which is submitted for assessment to Examination committee by Umme Habiba Tanny bearing Id: 172-34-661, Department of Nutrition and Food Engineering (NFE), Faculty of Allied Health Sciences, Daffodil International University.

I am pleased to declare that this report is entirely written by the author and all the works have been conducted by thesis work under co-supervision and observation by Major Md. Ashrafuzzaman Ph.D, EME, Associate Professor, Department of Biomedical Engineering, Military Institute of Science and Technology (MIST) and supervised by Prof. Dr. Md Bellal Hossain, Associate Dean, Faculty of Allied Health Sciences, Daffodil International University. This is a piece of original work and not has been submitted or published anywhere for any other purpose.

I strongly recommended the approval of the report by the authority and pursue a positive and fair evaluation of work. I wish him all the success in life.



Prof. Dr. Md. Bellal Hossain
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CERTIFICATION OF APPROVAL

I am pleased to certify that the Project report on **"Development of Beetroot Juice for Preventing Menstrual Cramps"** conducted by Umme Habiba Tanny, bearing ID No: 172-34-661 of the Department of Nutrition and Food Engineering has been approved for presentation and defense/viva-voice. I am pleased to hereby certify that the data and finding presented in the report are the authentic work of Umme Habiba Tanny. I strongly recommended the report presented by her for further academic recommendations and defense/viva-voice. She bears a strong moral character and a very pleasant personality. It has indeed a great pleasure working with her. I wish her all success in life.

_____

Ms. Fouzia Akter
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ACKNOWLEDGEMENT

I would like to thank all who has assisted and supported me in preparing thesis book. First and foremost, I'd like to thank Almighty Allah for giving me the strength and opportunity to complete the report within the timeframe allotted. I'd like to take this opportunity to thank everyone who has played a role in my life eventually. I owe my existence to my parents, without whom I would not exist. I 'm extremely grateful to my Supervisor, Professor Dr. Md. Bellal Hossain, Associate Dean, Faculty of Allied Health Sciences, Daffodil International University for his unwavering guidance during my organizational attachment and thesis work period. I would like to express my heartfelt gratitude and respect to Major Md. Ashrafuzzaman Ph.D, EME, Associate Professor, Department of Biomedical Engineering, Military Institute of Science and Technology (MIST). He guided me through each step of my thesis and internship work. My heartfelt appreciation goes to the respected Head of the Nutrition and Food Engineering Department, Ms. Fouzia Akter for her kind cooperation and acceptance of this Degree. Again, I would like to take the opportunity to express my gratitude to everyone who has been a part in all the ways of my life. I am grateful to the Director General of BRiCM, Dr. Mala Khan for granting me the internship and supportive opportunities to conduct thesis works at BRiCM. I would like to express my appreciation to the Scientific Officer, Mr. Pranab Karmaker for overseeing and assisting me throughout my thesis work during my stay at BRiCM. I am also grateful to all the scientific officers and lab technicians of BRiCM who have abetted me with technical skills and expertise. I'd like to express my heartfelt gratefulness to the Dean, Faculty of Allied Health Science and all the faculties and staffs of the Nutrition and Food Engineering Department for their boundless inspiration and encouragement during my time as a student. Finally, I'd like to give special thanks and love to my family, friends, and well-wishers.

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SUMMARY

Beetroot (Beta vulgaris) is a type of root vegetable that is also known as red beet, garden beet, table beet, or simply beet. Beetroots are high in nutrients. Beets are delicious raw, but they are more commonly juiced, cooked, or pickled. I have done my dissertation on beetroot juice by removing oxalate and I tried to observe how it works on women's bodies during menstruation. Menstruation is the normal vaginal bleeding that arises during a woman's monthly cycle. Periods generally start between the ages of 11 and 14 and last until menopause, which occurs around the age of 51. They typically last three to five days. Aside from vaginal bleeding. Women have experienced abdominal or pelvic cramping pain, lower back pain, bloating and sore breasts, food cravings, mood swings irritability, headaches, and fatigue during this time. A girl's life is undergoing emotional and physical transformations currently. The most common issue that women have with their periods is pain. More than half of women who have periods experience pain during their cycle. Some women may only experience feelings of heaviness in the abdomen or a tugging in the pelvic area. Other women have severe cramps that are not the same as premenstrual syndrome (PMS) pain. This is a very important issue for any girl of any country. I have compared two things because the health benefits of beetroot juice can eliminate the reasons why a girl suffers so much during menstruation. Beetroot have fiber, folate (vitamin B9), calcium, manganese, potassium, iron, sodium, and vitamin C, among other nutrients. Here, Magnesium may help in the prevention of menstruation pain. Magnesium may help some girls avoid dysmenorrhea (menstrual cramps). It reduces period discomfort by relaxing the uterine smooth muscle and decreasing the prostaglandins that cause it. Potassium can prevent a lot of muscle pains and the reduction of bloating. Sodium levels are lower during the follicular phase and higher during the luteal phase. In comparison to no treatment, placebo, or daily supplementation, iron in menstruation women may be a beneficial strategy for lowering anemia and improving hemoglobin concentrations. Calcium reduces core PMS symptoms and other negative effects like water retention, food cravings, and pain in the luteal phase of the cycle. Then vitamin C protects against skin problems. If all this quality is present in a food, then it will help to reduce the complication that girls face during menstruation. After making this juice, I checked its property in Bangladesh Reference Institute for Chemical Measurements. And I get a specific amount of calcium, magnesium, potassium, sodium, vitamin C in this juice. Which is effective in solving this problem. But no iron was found in Bangladeshi beetroot. But in the case of my report, the other nutrients which I found in beetroot after lab testing are very helpful in reducing the problem of menstruation. In our country girls are use some common treatments to reduce their complications. I did my work on 15- to 35-year-old women. These are common pain relievers, Prescribed pain relievers, Traditional remedies, Hot baths, Meditation, Exercise, Excess sleep or rest, herbal drinks, etc. But when they drink beetroot juice after some time, they feel good. My target was to reduce pain, inching, back or leg pain, mood swings, etc. And after a survey among 40 female volunteers, the feedback was too good, and a large target group of people agreed to drink it further.

CHAPTER ONE

INTRODUCTION

Beetroot is a highly nutritious vegetable that comes in a variety of colors and names around the world. It's a high-nutrient food. People are looking for a better way to improve their health and maintain a consistent lifestyle in today's climate. As a result, they are more likely to incorporate functional and organic foods into their well-balanced diets. Beetroot contains anti-inflammatory and antioxidant phytonutrients that aid in the prevention of skeletal muscle damage. Because of its high iron content, beet juice has been shown to improve blood circulation. It boosts the immune system and safeguards the liver and bile ducts [1]. Beetroot has antioxidant properties, carminative, cytotoxicity, anticancer, renal-protective, anti-hypertensive, anti-inflammatory, radioprotective, anti-fungal, anti-depressant, anti-microbial, expectorant, anti-diabetic, and anti-anemic properties [2]. It relieves pain and provides relaxation. It contains a high concentration of calcium, which reduces PMS symptoms as well as other negative effects such as water retention, food cravings, and pain during the luteal phase of the cycle. Women may experience increased menstrual cramps because of magnesium deficiency. They will feel so much better if they drink beetroot juice because there is 23gm of magnesium in 100g of beetroot [USDA]. As a result, beetroot has numerous health benefits, particularly for women's health.

1.1. Background

As an essential part of our daily diet, vegetables are high in bioactive components that provide nutritional and health benefits. Beetroot (Beta Vulgaris) is an alkaline food with a pH of 7.5 to 8, and it contains more antioxidants. Because of this nutritional source, it has a great nutritive value. Beets can be eaten raw, used to extract juice, baked, or boiled. Red beets are delicious browned, pickled, eaten in salads, or made into soup, a popular dish in many Eastern and Central European countries. People are now familiar with Bangladesh beetroot. Apart from fruits, the main sugar in beetroot is sucrose. For hundreds of years, beets have been used in traditional medicine to treat constipation, gut and joint pain, and dandruff. [3]. Beetroot (Beta vulgaris L.) contains high amounts of biologically active substances such as betaines, carotenoids, phenols, vitamin-C, B-vitamins (B1, B2, B3, B6, and B12), calcium, magnesium, vitamin, iron, potassium, folate, minerals, fibers, and sugars with low energetical value. This plant's various medicinal uses include antioxidant, anti-depressant, anti-microbial, anti-fungal, anti-inflammatory, diuretic, expectorant, and carminative, hepatoprotective, and cardiovascular health protector. Other advantages have been reported, such as lipid peroxidation inhibition and chemo preventive effects [4]. Beetroot is now a popular food in Bangladesh. Juicing is an important part of my thesis. We drink juice to boost our immune systems, lose weight, and feel more energized. In addition, fruits and vegetable juice are extremely nutritious for our bodies. Beetroot has a high nutritional value, and so does beetroot juice. The fiber in beetroot juice relieves constipation.

Because of the presence of nitrates in beetroot, it helps to partially lower high blood pressure. Nitric oxide, which is found in blood vessels and means allowing more oxygen to flow to our brain, heart, and muscles after consumption. It promotes glowing skin and prevents menstrual cramps. As a result, it has numerous health benefits. It is beneficial to girls' health if they consume it. Girls all over the world are experiencing menstrual cramps. They use a variety of traditional medicines. However, if healthy drinks can help to reduce these, it will be the best possible thing for girls. However, there are some disadvantages to drinking beetroot juice. It is the cause of the color of the urine and stool. And for the higher oxalate content. Kidney stones are to blame. I tried to remove as much oxalate as possible when making juice. As a result, regular consumption of this juice poses no risk to a woman kidney.

1.2. Objective:

The objectives behind this study to prepare beetroot juice for reducing female menstruation crumps such as:

- Reduce excessive menstruation pain
- Decrease excessive bleeding
- Introduce a women health drink with medicinal properties

CHAPTER TWO

LITERATURE REVIEW

2.1. Women Health

Menstruation is a regular occurrence in women's life, yet it is rarely acknowledged in public, and women's menstrual experiences, other than premenstrual syndrome and other more significant menstrual events, are little described. Periods are the body's mechanism of getting rid of tissue that is no longer needed. Every month, a woman's body prepares for pregnancy. The uterine lining thickens in preparation for the development of a fertilized egg. A fertilized egg is discharged into the uterine lining. Menstrual cycles are predictors of women's general health, and because menstruation is a life-long cycle of events, it is vital to examine menstruation across time. We propose in this study that there are links between women's early and present menstrual relationships, as well as their menstrual interactions and more general interactions with their cells and health [5]. Most females have their first period between the ages of 10 and 15. Even though the average life expectancy is 12, each girl's body functioned on its own schedule.

2.1.1. Menstruation Problems

Menstruation, also known as a period, is the regular flow of blood from the uterus through to the cervix and out through the vagina. Menstruation usually between the ages of sexual maturity and menopause [6]. Menarche is the age at which menstruation begins. Primary amenorrhea is the absence of menstruation despite signs of adolescence. Secondary amenorrhea is the absence of menstruation in a woman who has previously menstruated for 3-6 months. The term "dysfunctional uterine bleeding" refers to irregular uterine bleeding caused by anovulation or anovulatory cycle. Menarche occurs at the ages of twelve, nine, and sixteen. Menorrhagia is distinguished by regular menstrual cycles, excessive flow, and duration. Metrorrhagia is characterized by irregular menstrual cycles, excessive flow, and duration. A menstrual cycle that lasts more than 35 days is referred to as oligomenorrhea. When a menstrual cycle does not result in ovulation, this is referred to as anovulation or anovulatory. Menstrual cramping or pain is a common symptom of dysmenorrhea. All these symptoms can arise throughout menstruation [7].

2.1.2. Phases of Menstrual Cycle

The entire duration of a Menstrual cycle can be divided into four main phases such as Menstrual phase (From day 1 to 5), Follicular phase (From day 1 to 13), Ovulation phase (Day 14), Luteal phase (From day 15 to 28).

Menstrual Phase (Day 1-5)

The menstrual phase lasts from the first day of menstruation until the fifth day of the menstrual cycle. During this phase, the following incidents happen. Menstrual fluid is formed when the uterus expels its inner lining of soft tissue and blood vessels, which

exits the body through vagina. Regular blood loss ranges from 10 mL to 80 ml. Cramps may occur during this phase because of the deformation of the uterine and abdominal muscles to expel the menstrual fluid [8].

vagina. Regular blood loss ranges from 10 mL to 80 ml. Cramps may occur during this phase because of the deformation of the uterine and abdominal muscles to expel the menstrual fluid [8].

Follicular Phase (day 1-13)

This phase lasts until the 13th day of the menstrual cycle, much like the first day of menstruation. During this stage, the pituitary gland releases a hormone that encourages the development of egg cells in the ovaries. A follicle is a parenchyma structure in which one of these egg cells grows. An egg cell takes 13 days to develop. While the egg cell matures, its follicle secretes a hormone that stimulates the uterus to become an endometrial cell, which is a lining of arteries and soft tissue.

Ovulation Phase (day 14)

On the 14th day of the cycle, the pituitary gland releases a hormone, causing the ovary to contemplate releasing the developed egg cell. The fimbriae's cilia move the released egg cell into the fallopian tube. Fimbriae are finger-like extensions at the end of the fallopian tube near the ovaries, while cilia are hair-like projections on each fimbria. [8].

Luteal Phase (day 15-28)

This phase begins on the 15th day and continues till the cycle is finished. The following occurrences occur during this period. The egg cell is discharged during the ovulation phase and resides in the fallopian tube for 24 hours. The egg cell deteriorates if a sperm cell fails to fertilize an egg cell within that time range. The hormone that causes the uterus to keep its uterine lining has been depleted by the end of the menstrual cycle. As a result, the menstrual period of the following cycle begins.

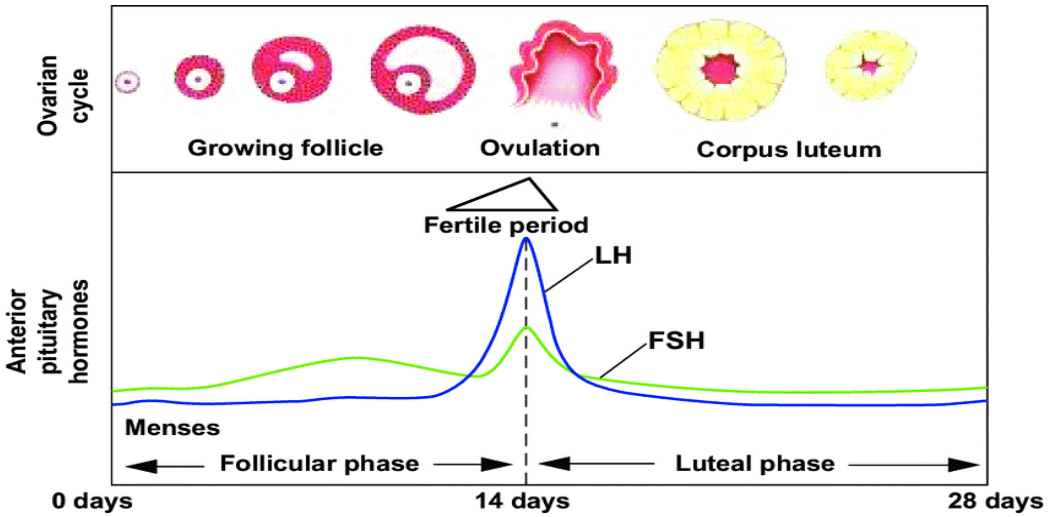

Figure 01: Menstruation Phase

2.2. Common Menstrual Disorder in Bangladesh

In Bangladesh, there are several menstrual disorders. Menstruation can range from painful, heavy periods to none. Menstrual cycles vary greatly, but women should be concerned if their periods are less than 21 days between, more than 3 months apart, or last more than 10 days. These occurrences might be the result of ovulation issues or other medical issues. Dysmenorrhea (Unpleasant Cramps) is a condition that causes painful cramping during menstruation. The pain starts in the lower abdomen and spreads to the pelvic region and thighs. Dysmenorrhea can be classified as either primary or secondary. Menstruation-related cramping is referred to as primary dysmenorrhea. Cramping is caused by uterine contractions, which are generally more severe after substantial bleeding. Secondary dysmenorrhea is menstrual discomfort that occurs in conjunction with another physical or physiological condition, such as pelvic pain or endometrial cancer. Menorrhagia (Heavy Bleeding) is characterized by a heavier and longer-lasting menstrual flow. Bleeding occurs monthly. It frequently lasts longer than 7 days, and women lose more than 80 ml of blood. Menorrhagia is frequently accompanied by dysmenorrhea because big clots can cause severe cramping. The lack of menstruation is defined as amenorrhea. There are two forms of amenorrhea: primary and secondary. These terms allude to the end of menstruation. When a girl reaches the age of 16, she is diagnosed with primary amenorrhea, which happens when she does not begin menstruation. If a girl under the age of 13 shows no signs of sexual development, she should be evaluated by a doctor. Any girl over the age of 15 who hasn't had her period for more than a month should be evaluated for primary amenorrhea. When prior regular periods stop for at least three months, secondary amenorrhea develops. Oligomenorrhea, often known as light or irregular menstruation, is a condition characterized by irregular menstrual cycles that last more than 35 days. It is common in adolescence and does not usually signal a medical concern. Premenstrual Syndrome is a collection of physical, emotional, and behavioral symptoms that can occur at any point during the luteal phase. Symptoms usually appear on day 13 or later of the cycle and disappear within 4 days of the commencement of bleeding. Symptoms of premenstrual syndrome can occur at any time throughout a woman's reproductive cycle, although they are most common in her late twenties to early forties [9].

2.3. Menstruation Issues in Bangladesh

Menstrual health is one of the most visible yet under-prioritized gender-related problems, which is tragically segregated as a women's issue rather than acknowledged as a public health burden and an impediment to nation-building. Despite this, period health remains a low-priority issue in Bangladesh, beset by taboos, shame, misinformation, and inadequate access to sanitation and menstrual products. When asked about their knowledge of menstruation, whether from school, madrasa, or girls, ‘shyness' was a common response. Menstruation is a social taboo in Bangladesh, with discussions about menstrual health and menstrual hygiene management (MHM) taking place only behind closed doors. As a result, there is widespread ignorance about MHM and menstruation in general. In other cases, women are uninformed of proper hygiene routines. This is due not just to the taboo nature of the problem, but also to a lack of information and understanding about women's reproductive health and rights (SRHR).

"Menstruation is a monthly discharge of impure blood," was one of the most widely held ideas regarding menstruation. Through this duct, dirt is evacuated from the body. It is an indication of maturity. It is a natural, God-given quality. It occurs once a month. Every month, ladies are affected by this health problem." According to a survey conducted in Bangladesh, just 7.23 percent of girls heard about menstruation through official sources, whereas 92.7 percent learned about it from informal sources (mother, sister, and close relatives). Period poverty is described as a lack of access to sanitary products, period hygiene education, bathrooms, handwashing facilities, and/or waste disposal facilities. Period poverty is widespread in Bangladeshi communities because many people see menstruation products as an indulgence rather than a right. Furthermore, almost 95 percent of the female population lacks access to sanitary pads, which leads to infections and increased absences from school or job. Cultural ideas and social standards place a significant burden on menstruating women, limiting their participation in culture, and preventing real growth. This article discusses menstruation and period poverty in Bangladesh [10].

2.4. Village and City Scenario

Prior to menarche, just 37.52 percent of girls were aware of menstruation. There was a significant variation in menstruation awareness between urban and rural locations. Only 36% of urban girls and 54.88% of rural girls used homemade sanitary pads and reused them the next period. Only 47.63 percent of females in cities and 37.96 percent of females in rural areas cleansed their external genitalia thoroughly. Cloth pads, which are reusable and washable, are often used by rural ladies. They do the washing and drying outside in the sun. However, it has been shown that when it is not thoroughly cleaned, many illnesses occur. If sanitary pads or materials are unclean, bacteria can cause local infections or travel up the vagina and into the uterine cavity. Changing pads are rarely used. Wet pads can irritate the skin, which can lead to infection if the skin breaks. If unclean material is put into the vagina, bacteria may have easier access to the cervix and uterine cavity. They can, however, use it if it is entirely dry. Sunlight is a natural sterilizer, and drying cloths in it sterilizes them for future use. These cotton pads are affordable, readily accessible, and ecologically friendly because they are disposable. They must also be stored in a clean, dry environment for reuse to minimize infection. However, urban women typically use sanitary pads, tampons, and menstrual cups instead of clothing. These new procedures are more efficient and sanitary, such as: Commercial Sanitary Pads are readily available in a wide range of stores, pharmacies, and online. They cost more than cotton pads, are not reusable, and are harmful to the environment. Cotton used in their production is not totally natural and may include pesticides. They are the type of absorbent that protects the inside. They are a soft (cotton) plug that is inserted into the vagina to catch the menstrual flow before it leaves the body. They are expensive, not easily biodegradable in nature, and hence not very environmentally friendly. Tampons made from sea sponges are now available on the market as a natural alternative to synthetic tampons. Menstrual Cups, as an alternative to sanitary pads and tampons, may be a new technology for poor women and girls. They are like cups made of medical grade silicone rubber, which allows the cup to be easily folded and inserted into the vagina to collect menstrual blood. They can be worn for up to 6–12 hours, depending on the amount of menstrual flow; hence, they need to be removed and filled less frequently. They are reusable and environmentally friendly. In locations where sanitation is lacking, it provides a long-term, practical, and

cost-effective solution. Bamboo fiber padded swaths Instead of wood pulp, bamboo pulp is used as an absorbent material in these sanitary pads. It has a better absorption capacity and hence is less dangerous to use. They are low-cost, easily degraded, and ecologically friendly antibacterial pads. Therefore, menstruation is free of infection and discomfort. There are also bamboo charcoal pads on the market that do display blood stains and are reusable in nature. This approach is advantageous to female health. [11].

2.5. Existing medications and Solutions

Bangladeshi girls are use different types of painkillers with the advice of a doctor in case of major complications during the menstruation. Some girls are use common painkiller without the prescription. They also use a variety of aromatherapy and traditional remedies. Other things they also use such as: hot baths, meditation, exercise, excess sleep or rest, Any herbal drinks. But beneficial things are aroma and herbal therapy at the same time beneficial diet. Daily requirement of nutritional supplements for menstrual disorders:

Table-01: Daily requirement of nutritional supplements for menstrual disorders

Vitamin A	Vitamin A is required for adolescent growth and development, as well as healthy endometrial growth. Women who experience regular menstruation loss have substantially greater levels of vitamin A than menorrhagia patients. When women with considerable menstrual loss were given vitamin A, their menstrual cycle improved. [12].
Magnesium	Magnesium supplements can aid with PMS symptoms such aches and pains, depression, irritability, mood swings, and fluid retention. Magnesium helps to relax smooth muscular tissue. It has been shown to dramatically reduce period cramps. [13].
Omega-6 essential fatty acids (EFAs)	Borage oil and evening primrose oil are high in omega-6 fatty acids. Omega-6 fats can aid conception by strengthening reproductive cell structure, reducing inflammation, and improving the general health of the body's organs. Borage and EPO aid in uterine reduction. [14].
Fermented Cod Liver Oil	Many of the necessary building blocks for hormone production, such as vitamins A, D, and K, are present. It also contains a lot of Omega-3 fatty acids and other good lipids. [15].

Gelatin	It contains a lot of calcium, magnesium, and phosphate. It increases hormone production and intestinal health while also lowering inflammation, especially in the joints. [16].

2.5.1 Benefits of Aroma therapy for Painful Menstrual Cramps

Another type of pain alleviation for menstrual cramps is essential oil massage blends or hot compresses. The aromatherapy massage, which should be done every day between periods, reduces the number of days of menstrual discomfort significantly. Some of the greatest aromatherapies for unpleasant cramps are listed below.

Heat

Applying heat to the lower abdomen is the simplest way to relieve menstruation cramps. Heat helps to soothe the cramping muscles of the uterus. Alternatively Apply heat to the lower abdomen and lower back with a heating pad or a plastic bottle filled with hot water until the ache goes away.

German Chamomile

The anti-inflammatory benefits of German chamomile oil are widely known. This oil has a strong blue hue due to the presence of azulene. It also has some pain-relieving qualities, increases nerve relaxation, and reduces irritability, impatience, and melancholy, all of which are common menstrual symptoms. [17].

Sweet Marjoram

This oil is especially great for menstrual cramps since it soothes pain on several levels. It is best used in combination with a hot compress on the abdomen when menstruation pains occur [18].

Sweet Fennel

Although fennel essential oil can help to stimulate menstruation (menses) and manage monthly flow, it is ineffective in alleviating menstrual discomfort.

Lavender oil

This essential oil extracted from the flower spikes of some lavender species aids in the relief of anxiety, sadness, and discomfort associated with menstruation [19].

Clary Sage oil

Clary Sage Essential Oil is obtained from the buds and leaves of the Salvia Sclarea plant through a distillation process, and it regulates menstrual cycles and alleviates menopausal symptoms [20]

2.5.2 Physical activity for menstrual disorder

Regular physical activity is essential for enhancing the flow of qi in the body. A lack of exercise may aggravate the severity and duration of dysmenorrheal symptoms. In addition to a regular physical exercise routine, a proper movement meditation may help balance emotions, reduce stress, strengthen organs, and regulate menstruation. Regular activity, such as exercise before and during your menstrual cycle, can and will help to reduce the severity of menstrual cramps. Swimming may also aid in the reduction of menstrual flow and cramps [21]

List of common herbs used in uterine disorder

Table 02: List of common herbs used in uterine disorder [9].

Name	Used parts	Methods of use
Red raspberry	Leaf	Make a strong cup of blackberry leaf tea and add orange juice to it. If you have discomfort during your menstruation, take 3 cups of this combination every day.
Basi	Leaf	To one cup of boiling water, add 15 mL of basil leaf extract. Allow to cool before covering firmly. To relieve cramps, drink this every few hours.
Cinnamon	Bark	Cinnamon Sticks Cinnamon is a fiery and fragrant herb that is taken as an extraction at a dose of up to 1 g three times per day, or as part of an herb's mixture at a dose of 2–4 ml three times per day.
Ginger	Ginger root	Ginger can be consumed fresh, as a rhizome infusion, or as a tincture. The extract (tincture) is given in a dose of 2.5–3 ml, depends upon the strength. Lower dosages are advised during menstruation.
Parsley	Leaf	The fresh parsley leaf is Pour in 1 cup of boiling water and steep for 5 minutes. Drink the tea right away after straining the solution. To reduce discomfort during periods, drink this tea twice a day.

Yarrow	Whole Herb	Yarrow herb is used as tea, which is made by covering 15 g of dry herb with boiling water and infusing it overnight. After filtering, the tea is consumed in divided doses the next day during periods of heavy menstruation.
Chamomile	Leaf	One cup of boiling water is placed into a cup with a chamomile tea bag inside. Allow it is too steep for 10 to 15 minutes, covered. Squeeze the tea bag and, if desired, add some lemon juice or honey. Then, during the week preceding your monthly period, consume at least two cups of chamomile tea every day.

2.6. Beetroot and Beetroot Juice

In Bangladesh, just 16% of farmers grew beetroot on the fewest number of fields. Many farmers (37%) have only recently started growing beetroot vegetables as a new crop and have less than six months of cultivation experience. Longer cultivation experience (greater than years, such as 10 to 20 years old) was recorded for 26 percent of farmers, because most of the farmers included in this study were over 50 and had a long history of beetroot farming. It was shown that most beetroot farmers (70 percent) had hills, whereas just 10% had lowland for beetroot farming. Because the beetroot vegetable was recognized as a unique crop in Bangladesh with numerous health benefits and grew popular due to its colorful appearance, most participating farmers (53 percent) produced it as a hobby. However, just 32% of farmers grow it for commercial purposes. The beet is a temperate crop that was successfully developed by the global agrochemical company "Syngenta." It began with the cultivation of numerous sugar beet genotypes in tropical climates [23]. Beets are an immune-boosting food that includes minerals including magnesium, salt, potassium, vitamin C, and betalaine, all of which act as antioxidants, antimicrobials, and antiviral agents. Because this vegetable contains a variety of active compounds such as carotenoids, saponins, betacyanines, betanin, polyphenols, and flavonoids, it is commonly expected to aid in the prevention of numerous life-threatening illnesses such as cancer. For example, betalains from beetroot, which contain betacyanins and betaxanthins, can both prevent and treat hypertension/cardiovascular problems while also suppressing cell proliferation in human tumor cells. In 2015, the global functional foods and beverages market was valued at 129.39 billion USD, and it is growing at an 8.6 percent CAGR (compound annual growth rate). Beetroot utilization for food application has been explored by various researchers and food companies due to the predominant effect of their color, flavor, and nutritional aspect, making it a super food and a miracle vegetable. Humans eat deep red beets both raw as salad and cooked in stews. Beetroot is consumed all throughout the world. Beetroot soup is a classic Eastern European cuisine and pickled 16 beets are a traditional South American delicacy. Nowadays, a significant proportion

of beetroot is used in the commercial production of pickles. Beetroot juice is made using little quantities of beetroot. Beetroots are commonly used in Australian sandwiches. Fresh beetroot leaves and stems are eaten raw, whilst older stems are stir-fried. Beetroot may be used to replace synthetic colorants and as a food marketing technique. Consumers are also interested in green consumerism, which involves using fewer synthetic materials. Natural colorants are not harmful to humans when consumed. As a result, natural colorants are more likely to find commercial application as food additives than synthetic colorants. When taken in high numbers, synthetic colorants are detrimental to human health, cause allergies, and have a carcinogenic effect. Because natural colors are water-soluble, they are simple to include into aqueous food systems. Colorants make this natural meal more attractive, improve visual acuity, and may give health advantages thanks to potent antioxidants. Beets are most found in two forms for food and beverage manufacturers: crushed dehydrated beets and beet juices. Beet powder may be created by dry mixing dried beets and beet juices. Fresh beetroot or beetroot powder or extracted pigments are used to enhance the red color of tomato pastes, soups, sauces, sweets, jams, jellies, candies, ice cream, and morning cereals. Beetroot juice is used to color a variety of meals, including dairy, yogurt, processed cheese, and confectionery. It is exclusively used in ice cream, sweets, and other confectionery items since it changes color when heated. It may be used in mayonnaise recipes in place of synthetic antioxidants, either fresh or freeze-dried. Supplementing with beetroot juice enhances tolerance to high-intensity sports and physical activities. Beetroot juice is beneficial to one's health. It is beneficial with menstrual cramps. People feel more refreshed, relaxed, and healthier after drinking this juice. Beetroot hues are non-allergenic and have no bad side effects. According to sugar, several studies have discovered that beetroot may be utilized to produce a range of culinary dishes. Beets are used to produce sugar, and its byproducts such as pulp, molasses, fiber, and so on are used as animal feed. When sugar beetroot is grown in animal-producing areas, the plant's leaves can be used as fodder. The extremely complex process of sugar production begins with fluming, continues with flushing, and culminates with the refinery, with the ultimate products being sugar, molasses, and bagasse. Molasses is used in the manufacture of alcohol as well as other types of fermentation. Because of its health advantages, beetroot is becoming increasingly popular in Bangladesh. [22].

Figure 2: Beetroot

2.6.1. Nutrient Content Amount of Beetroot

The taproot of the beet is the beetroot. Several cultivated forms of Beta vulgaris are developed primarily for their tasty taproots and greens. These cultivars are part of the B. vulgaris subsp. vulgaris conductive group. Beetroot juice is also extremely good to one's health. From the previous research of raw beetroot nutrition contents are:

Proximate Values of Beet Root

Table-03: Protein, Fat and Fatty Acid, Carbohydrates, Vitamins, Minerals and Calorie Proximate nutrient value of Raw Beetroot [24]

Protein Information	
Nutrient	**Amount**
Protein	1.3
Fat and Fatty Acid Information	
Total fat	0.1 g
Saturated fat	0.0 g
Mono- saturated fat	0.0 g
Poly saturated fat	0.0 g
Total Omega-3 fatty acid	4.1 g
Total omega-6 fatty acid	45.1 g
Carbohydrates Information	
Total Carbohydrate	7.8g
Dietary Fiber	2.3g
Starch	0.0g
Sugar	5.5g

Vitamins Information	
Vitamin A	27.1 mg
Vitamin C	4.0 mg
Vitamin E	0.0 mg
Vitamin K	0.2 mg
Thiamin	0.0 mg
Riboflavin	0.0 mg
Niacin	0.3 mg
Vitamin B6	0.1 mg
Folate	89.4 mg
Vitamin 12	0.0 mg
Pantothenic Acid	0.1 mg
Choline	4.9 mg
Betaine	106 mg
Minerals Information	
Calcium	13.1
Iron	0.7
Magnesium	18.9
Phosphorus	32.8
Potassium	267
Sodium	64.0
Zink	0.3
Copper	0.1
Manganese	0.3
Selenium	0.6
Calorie Information	
Total Calorie	35.3g
From Carbohydrate	30.4g
From fat	1.2g
From protein	3.65g

2.6.2. Potential Health Benefits of Beetroot

Beetroot contains bioactive compounds with antianemia, anti-inflammatory, anti-hypertensive, antioxidant, anticarcinogenic, antipyretic, antibacterial, detoxicant, and diuretic properties. Several parts of the beetroot plant exhibit these traits. By insulating the damaged tissue, betacaine possesses a wide spectrum of therapeutic, anticarcinogenic, hepatoprotective, and anticancer properties and had no obvious impact on normal cell lines. Betaine pigments have been shown to have a role in the chemoprevention of lung and skin cancers, and it has been reported that they can impede the cell proliferation of a variety of human tumor cells. Vitexin, vitexin-2-O-rhamnoside, and vitexin-2-O-xyloside, flavonoids present in beets, have been demonstrated to have antiproliferative activity on cancer cell lines. They have anticarcinogenic effects, somewhat reduce inflammation, and modulate immune response. Beetroot nitrates can lower blood pressure, protect against ischemia-reperfusion injury, and regulate mitochondrial function. It decreases blood pressure, bad cholesterol, and oxidized LDL cholesterol. Beetroot extracts contain antihypertensive and hypoglycemic effects. Betaines work by reducing homocysteine levels, which maintains vascular homeostasis, protects platelet function, thrombotic activity, vascular tone, and the delicate balance of vasodilating and vasoconstricting substances released. Endothelial dysfunction is a risk factor for cardiovascular diseases such as hypertension and atherosclerosis. Beetroot consumption reduces the likelihood of inflammation (an innate reaction characterized by infection, erythema, edema, trauma, fever, and pain produced by cell damage induced by high blood pressure). Although betalains extracts preserve the thin lining of blood vessels and prevent inflammation, existing pharmacological treatments have undesirable side effects. An anti-inflammatory effect of beetroot ethanolic extract on gentamicin-induced nephrotoxicity was identified. The water made from boiling beets is a good therapy for skin infections including pimples and pustules. Beetroot is good for the digestive system. The proposed mechanism is based on a significant reduction in cleaved caspase 3, decreased Bax protein expression, and increased Bcl-2 protein expression. The phytochemicals in red beet aid to sustain the hematological system, immune system, kidneys, and liver. Beetroot phytochemicals reduce age-related oxidative stress while also supporting cognitive activities such as perception, learning, communication, and decision making. Nitric oxide (NO) is produced by beetroot, which can enhance

cerebrovascular flow. Supplementing with dietary nitrate (NO3 -) has been demonstrated to improve cerebral hemodynamics, neurovascular coupling in response to visual stimuli, and perfusion to brain areas associated with executive function. Beetroot consumption elevated plasma nitrate levels by about 96%. When nitrite enters the stomach's acidic medium, part of it is converted into nitric oxide, while the remainder is absorbed to multiply circulating plasma nitrite. Beet juice is good for the skin, and a mixture of vinegar and beet juice removes dandruff and soothes running sores and ulcers. It also has a high concentration of boron, which is required to produce human sex hormones. Beetroot juice consumption enhances cardiovascular health and promotes physiologic responses to exercise. These properties are caused by the fast endogenous production of nitric oxide. Due to its high iron content, which regenerates and reactivates red blood cells and delivers new oxygen to the body, beetroot juice is considered to help in blood purification and is a superb blood builder. Beetroot contains both macronutrients and micronutrients, which contribute to its exceptional physiological properties. Folic acid, contained in beets, helps to prevent cancer, and vitamin B, found in beetroot, promotes the proper functioning of the nervous system. Regular use of beetroot products protects against oxidative stress-related disorders and aids digestion. The copper presence in beetroot helps to make iron more available to the body. The root of the beet is used to treat fevers and constipation. Many pharmacological tests conducted by experts determined that beetroot was effective and advantageous in the treatment of several ailments. Furthermore, the anti-stress, anti-anxiety, and anti-depressive activities of beetroot leaf extract were investigated in mice. In agitated rats, it exhibits anxiolytic and antidepressant qualities, as well as antioxidant capabilities. Uridine, derived from sugar beets, can be used with omega-3 fatty acids to help individuals feel less stressed or prevent depression by modifying their mood and relaxing their body. Antiviral, antibacterial, and antiradical effects have been demonstrated for betalains pigments. Beetroot saponins have been shown to be effective against a wide range of human cancers, including prostate, kidney, breast, colon, lung, leukemia, and melanoma [22]. Folate, magnesium, calcium, iron, potassium, and salt are all abundant in beets. Folate is a B vitamin that is required for normal tissue development and cell function. It is especially important for expecting moms. Magnesium is a trace element that is abundant in beets. In certain women, magnesium may help avoid dysmenorrhea (menstrual cramps). It alleviates period

discomfort by relaxing the uterine smooth muscle and decreasing the prostaglandins that cause it. Potassium-rich meals can help decrease blood pressure and improve heart health. Potassium can aid with a range of muscle issues, including bloating. Sodium levels are lowest during the follicular phase and highest during the luteal phase. When compared to no therapy, placebo, or daily supplementation, iron supplementation in menstrual women may be a viable technique for lowering anemia and boosting hemoglobin concentrations. Iron is a necessary mineral that performs several functions in the body. It is necessary for red blood cell oxygen delivery. Vitamin C is a well-known antioxidant that is required for both immune function and skin health. Calcium reduces PMS symptoms as well as other unwanted side effects such as water retention, food cravings, and pain during the luteal phase of the cycle.

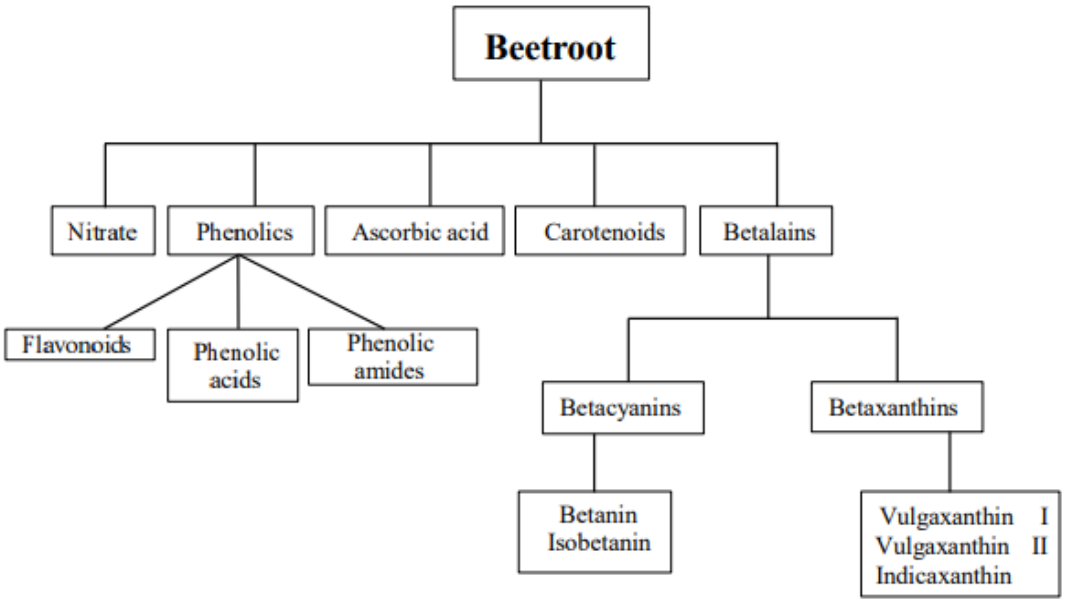

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Figure-03: Potentially bioactive compounds in beetroot

CHAPTER THREE

MATERIALS AND METHOD

3.1. Materials

For Beetroot juice making I used firstly fresh raw beetroot from (Local Market), Purifying water (Lamor, Reverse Osmosis System), Refined sugar (Fresh), Flavor (Bongo Flavor), Citric Acid (Merck Specialties Private Limited), Vitamin C (Local Market), Aspartame (Local Market), Xanthan Gum (Germany), Sodium Benzoate (Qualikems Fine Chem Pvt. LTD), and Potassium Sorbate (Local market).

3.2. Instruments and Equipment

For making beetroot juice and testing I used: Beaker (Gitesh Beakers Cylindrical Glass Beaker 500MI), Funnel, Hot Plate Magnetic Stirrer (Laboratory Hot Plate), Filter Paper, Oven (ECO CELL), Thermometer, PH meter (Mettler Toledo), Refractometer (Automatic ABBE), Bottle, Spoon, Bowl, Juicer machine (WBL-VK01), Food Mixture machine (CVSTAR), Test tube, Knife, Weight machine (Mettler Toledo), Chopping board, Foil paper, Parafilm tape, Centrifuge machine (Compact Centrifuge), Flame Atomic Absorption Spectroscopy (AA 7000), HPLC (SPD-20A), Muffle Furnace (Select Horn), Microwave digestion (Milestone Ethos easy), Protein digestion (DKL-20), Autoclave (PTS-B50L), Petridis, Bio-active Laminar Airflow Cabinet II (BIO II A), Vortex (HWASHIN 250VM), Digital colony counter (FTCC-10), Falcon, Syringe filter, Water bath (GFL), Crucible, Pipette, The Automatic Distillation Titration System (UDK-159 VELP SCIENTIFICA), Vacuum Filter (R-300), Incubator (Esco Scientific), Desiccator.

3.3. Methods

Here is the following method AOAC- 920.149 for preparation of fruit juice test sample: Shake thoroughly to produce a homogenous test sample, and then filter through absorbent cotton or quick paper. Make fresh juice by pressing and filtering well-pulped fruit. Fruit juice is extracted and filtered using a commercial apparatus.

3.3.1. Preparation of Beetroot Juice

At first, I took 2kg raw beetroot then sorted, washed it with treated water, peel the skin, sliced it by the shape of cube 3-4mm thick, then reweighed it with the aid of digital electronic balance. It was 1.7kg. Then it was granted into mash for better juice extraction by using a blender for 15min total. Then filtrated by using muslin cloth folded into 2 layers. Separated liquid and solid parts. I put this juice in a container [25]. Another two times I filtered it by using a hot plate magnetic stirrer and filter paper for removing oxalate. Juice left in the food mixture machine which was rotating at high

speed for 15 min remove sedimentation. By adding preservatives and flavor I preserved juice in a sealed bottle.

Figure 4: Beetroot juice

3.3.2 Produce Beetroot Juice Making

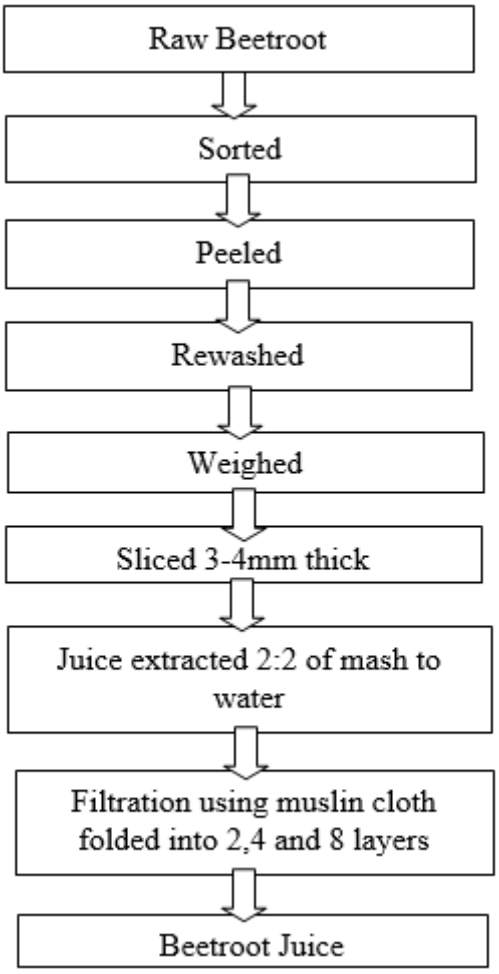

Figure 5: Flow Chart to produce Beetroot Juice

3.4. Sample Details

By the laboratory machineries Chemical, physical and biological properties checked purposes of the quality of beetroot juice. Here used six sample for all the tests. There was raw sample, final processed sample, commercially processed sample, before eight-, six- and three-month sample. There are tested in laboratory how much iron, calcium, magnesium, sodium, potassium, protein, vitamin -c are contain each sample. There are also tested pH, brix, ash, moisture, viscosity, and microbiology test (E-coli, Fungus, Bacteria).

3.4.1. Sample 1 (Raw Juice)

First, I sorted 500g raw beetroot, rinsed it with treated water, peeled the skin, cut it into cubes 3-4mm thick, and reweighed it using a digital electronic scale. It weighed 400gm. Then it was blended for 15 minutes to make a mash for greater juice extraction. The filter was then made using muslin cloth folded into two layers. Separated liquid and solid components This juice is in a container. I preserved juice in a bottle.

3.4.2. Sample 2 (Final Juice)

First, I sorted 500g raw beetroot, rinsed it with treated water, peeled the skin, cut it into cubes 3-4mm thick, and reweighed it using a digital electronic scale. It weighed 400gm. Then it was blended for 15 minutes to make a mash for greater juice extraction. The filter was then made using muslin cloth folded into two layers. Separated liquid and solid components This juice is in a container. I strained it two more times with a hot plate magnetic stirrer and filter paper to remove oxalate. The juice was placed in the food mixing machine for 15 minutes while it rotated at high speed to eliminate sedimentation. I preserved juice in a bottle after adding preservatives, Benzoic acid 120mg, Water 30%, Citric acid 2gm, Flavor 2ml, Sugar 12%.

3.4.3. Sample 3 (Commercial Juice)

First, I sorted 500g raw beetroot, rinsed it with treated water, peeled the skin, cut it into cubes 3-4mm thick, and reweighed it using a digital electronic scale. It weighed 400gm. Then it was blended for 15 minutes to make a mash for greater juice extraction. The filter was then made using muslin cloth folded into two layers. Separated liquid and solid components This juice is in a container. I strained it two more times with a hot plate magnetic stirrer and filter paper to remove oxalate. The juice was placed in the food mixing machine for 15 minutes while it rotated at high speed to eliminate sedimentation. I preserved juice in a bottle after adding preservatives, Benzoic acid 120mg, Water 30%, Citric acid 2gm, Flavor 2ml, Sugar 12%, potassium sorbate 0.75g, aspartame 25-piece, xanthan gum 4.5gm.

3.4.4. Sample 4 (Before 8 month)

First, I sorted 500g raw beetroot, rinsed it with treated water, peeled the skin, cut it into cubes 3-4mm thick, and reweighed it using a digital electronic scale. It weighed 400gm. Then it was blended for 15 minutes to make a mash for greater juice extraction. The filter was then made using muslin cloth folded into two layers. Separated liquid and

solid components This juice is in a container. I strained it two more times with a hot plate magnetic stirrer and filter paper to remove oxalate. The juice was placed in the food mixing machine for 15 minutes while it rotated at high speed to eliminate sedimentation. I preserved juice in a bottle after adding preservatives, Benzoic acid 120mg, Water 30%, Citric acid 2gm, Flavor 2ml, Sugar 12%.

3.4.5. Sample 5 (Before 6 month)

First, I sorted 500g raw beetroot, rinsed it with treated water, peeled the skin, cut it into cubes 3-4mm thick, and reweighed it using a digital electronic scale. It weighed 400gm. Then it was blended for 15 minutes to make a mash for greater juice extraction. The filter was then made using muslin cloth folded into two layers. Separated liquid and solid components This juice is in a container. I strained it two more times with a hot plate magnetic stirrer and filter paper to remove oxalate. The juice was placed in the food mixing machine for 15 minutes while it rotated at high speed to eliminate sedimentation. I preserved juice in a bottle after adding preservatives, Benzoic acid 120mg, Water 30%, Citric acid 2gm, Flavor 2ml, Sugar 12%.

3.4.6. Sample 6 (Before 8 month)

First, I sorted 500g raw beetroot, rinsed it with treated water, peeled the skin, cut it into cubes 3-4mm thick, and reweighed it using a digital electronic scale. It weighed 400gm. Then it was blended for 15 minutes to make a mash for greater juice extraction. The filter was then made using muslin cloth folded into two layers. Separated liquid and solid components This juice is in a container. I strained it two more times with a hot plate magnetic stirrer and filter paper to remove oxalate. The juice was placed in the food mixing machine for 15 minutes while it rotated at high speed to eliminate sedimentation. I preserved juice in a bottle after adding preservatives, Benzoic acid 120mg, Water 30%, Citric acid 2gm, Flavor 2ml, Sugar 12%.

3.5. Physical Property Check

Identification in physical properties of beetroot juice such as: pH, Brix, Moisture, Ash etc.

3.5.1. Identification of pH

At first adjust the buffer. Then take filter sample in a beaker and then calculate pH by pH meter (AOAC: 2005.02).

3.5.2. Identification of Brix

At first set the method in refractometer. Take 25ml sample in a distillation flask. Then take 100ml H2O and sample and inject it sample injection portion. After that count the brix. (AOAC-950.04 Appendix -C)

3.5.3. Determination of Moisture

Beetroot juice sample ash determination method following AOAC-945.62 (2005).

Sample Preparation:

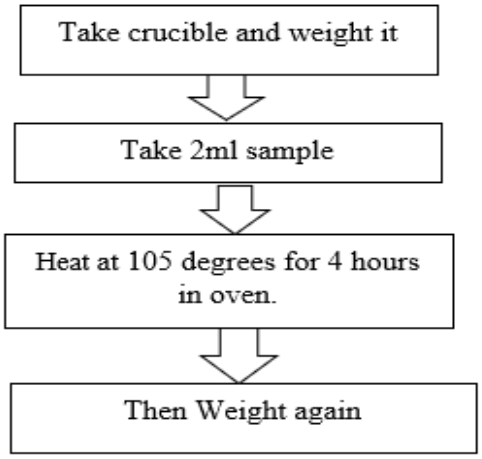

Figure 6: Moisture Determination

3.5.4. Determination of Ash

Beetroot juice sample ash determination method following AOAC-940.26 (2005).

Sample Preparation:

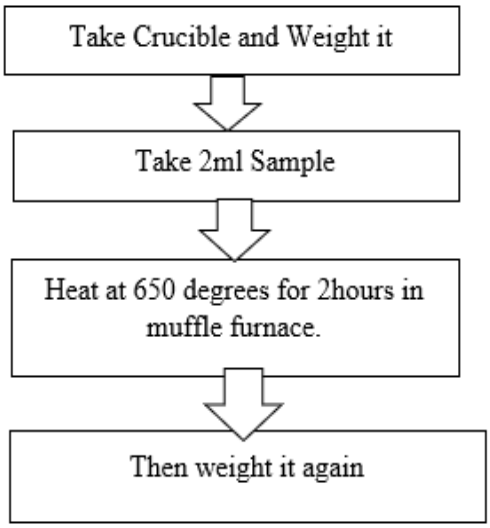

Figure 7: Ash Determination

3.6. Chemical Property Check

To identify Chemical property did the laboratory taste to see if there were any health benefits in the beetroot juice which protect menstruation crumps. And there got an enough amount of all. After testing got calcium, magnesium, sodium, potassium, vitamin-c, protein. But cannot get iron in Bangladeshi beetroot.

3.6.1. Determination of Benzoic Acid

Take 10 ml filter juice in 50ml centrifuge tube. Centrifuge at 1500 rpm in 5 min. Wash C18 cartridge by 2ml MeOH wash by 5ml H20. Then 1ml supernatant sample through cartridge. Wash cartridge by 3ml 2% ACN and discard elute in tube and make it up to 3ml. Syringe filtration. Machine runs. (AOAC-994.11).

3.6.2. Determination of Calcium

Take 0.2 ml sample. Add 8ml HNO3. Transfer for microwave digestion with the following method. After up to mark 25 ml. Filter and add LaCl3. Then up to mark for machine run. (AOAC-985.35)

3.6.3. Determination of Sodium

Take 0.2 ml sample. Add 8ml HNO3. Transfer for microwave digestion with the following method. After up to mark 25 ml for machine run. (AOAC-985.35)

3.6.4. Determination of Iron

Take 0.2 ml sample. Add 8ml HNO3. Transfer for microwave digestion with the following method. After up to mark 25 ml for machine run. (AOAC-999.10)

3.6.5. Determination of Potassium

Take 0.2 ml sample. Add 8ml HNO3. Transfer for microwave digestion with the following method. After up to mark 25 ml for machine run. (AOAC-985.35)

3.6.6. Determination of Magnesium

Take 0.2 ml sample. Add 8ml HNO3. Transfer for microwave digestion with the following method. After up to mark 25 ml. Filter and add LaCl3. Then up to mark for machine run. (AOAC-985.35)

3.6.7. Determination of Protein

By utilizing Kjeldahl technique accompanied by the machine. The protein was extracted using the Kjeldahl technique. The essential idea behind this approach was to digest the sample with concentrated sulphuric acid (H2SO4) and a digestion combination, which causes protein oxidation and degradation as well as organic nitrogen conversion to ammonia, which remains in the acid mixture as ammonium bicolpate. The quantity of ammonia nitrogen was calculated by alkalinizing the digest, then distilling the liberated ammonia into a standard acid solution and estimating

titrimetrically. Cleaned and dried 100 ml Kjeldahl flasks, a 0.5ml sample, and ash-free filter paper were utilized. After adding roughly 10 ml of concentrated H2SO4 and I: I gm digestion mixture, the digestion chamber was heated for 6 hours (sodium sulfate and mercuric oxide). After the digestion was completed, the flask was chilled, and the digested mixture was transferred to a 100 ml volumetric flask and diluted to the mark using distilled water. After adding 5 ml of 50% NaOH and 2.5 ml of 15% Na2S2O3, ten (10 ml) of the solution was transferred to a micro Kjeldahl distillation unit. For five minutes, the solution was distilled using steam. The distillate was titrated with 0.02 N HCI after being collected with solutions containing more than 2% boric acid. Simultaneously, in the absence of the material, a blank digestion was performed (AOAC- 984.13).

3.6.8. Determination of Vitamin-C

50ml liquid sample+ 50ml extracting solution. Then filter it. Then take 2ml of the solution from here and add 5ml of extraction solution. After that titrate with indophenol (AOAC-967.21).

3.6.9. Determination of Oxalate

Heat analyte and blank (5 ml H2SO4 [1+9] in 50ml centrifuge solutions in boiling water bath. Titrate hot solution with KMnO4 until pink color arrive (AOAC: 974.24)

3.7. Biological Test (A)

I did some biological test to identify the juice is good or not. I want to see any bacteria, mold, fungus, e-coli had grown in it and preservatives are works or not. There for in biological tests, I use EMB agar for E-coli determination, Nutrient agar for Bactria, SDA for fungus and mold. For dilution I used NaCl and water mixture.

3.7.1. Determination of E-coli

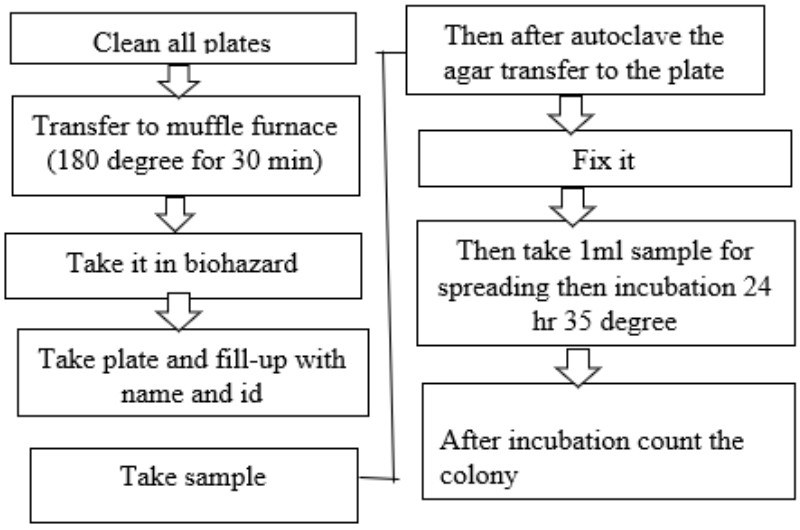

Figure 8: Determination of E-coli

3.7.2. Total Bacterial Count and Fungus and Mold (B)

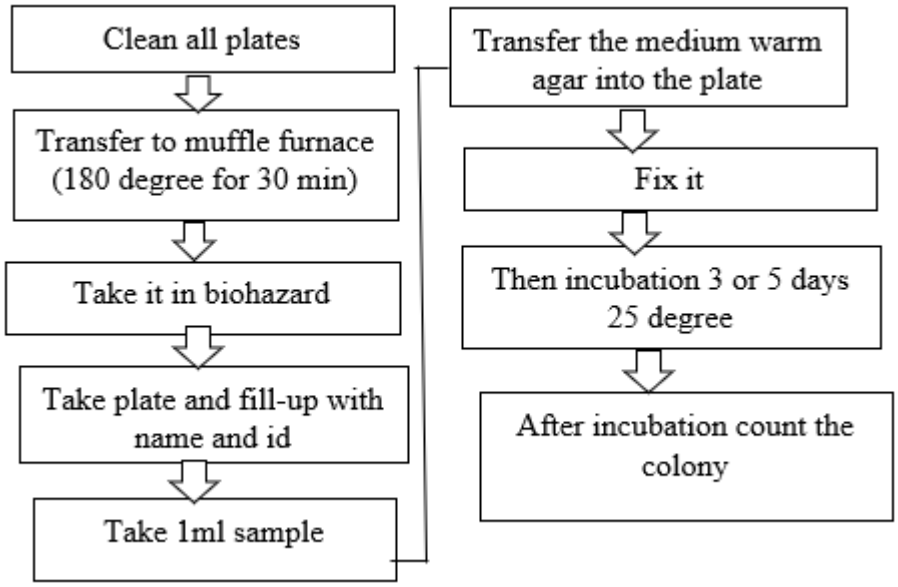

Figure 9: Determination of Total Bacterial Count and Fungus and Mold

3.7.3. Sensory Taste

Sensory assessment is a science that monitors, analyzes, and evaluates people's reactions to items as experienced by their senses. It is a method of establishing if product differences are perceived, the rationale for the differences, and whether one product is preferred over another. For this project sensory evaluation was descriptive test basis. The goal of descriptive analysis is to offer a description of the sensory properties of food. It is one of three fundamental types of sensory tests. Food comparisons are made using difference tests. Affective tests assess food preferences. These are sometimes referred to as consumer testing. Descriptive tests explain a food's sensory characteristics. The goal of descriptive analysis is to get a complete description of Aroma, Flavor and Oral texture. After that, by rating participants are provide their result. Judging take place in individual booths to ensure independent judgment and contact between panel members should be permitted except for consultation with the panel leader in the event of a tie. For sensory testing select time was the morning from 10:00 a.m. to 12:00 p.m. and in the afternoon from 3:00 p.m. to 5:00 p.m. The decision should be made fast, but not hastily. When they consume juice, they provide feedback about it and I collect it manually. Overall People was satisfied.

CHAPTER FOUR

RESULT AND DISCUSSIONS

The results on different parameters have been pointed into the table and figures as mentioned bellow:

4.1. A. Chemical Analysis of the sample

4.1.1. Moisture

After averaging all the sample, the moisture content is 0.188g. Desire sample moisture content is 0.2043g. As per methods of (AOAC-945.62) , the sample was analysed in laboratory and results are shown:

Table -1: Estimation of Ash of Beetroot sample

Sample	Empty crucible weight	Sample weight g	Last	Result
The sample 3 month ago	21.5905g	2.0058g	21.8433g	0.2528g
The sample 6 month ago	39.593g	2.0021g	39.8193g	0.2263g
The sample 8 month ago	37.5313g	2.0092g	37.6054g	0.0741g
Process sample	36.089g	2.0084g	36.2933g	0.2043g
Commercial Sample	21.7428g	2.0038g	22.0388g	0.296g
Raw Sample	37.1070g	2.0056g	37.1807g	0.0737g

4.1.2. Ash

After averaging all the sample, the ash content is 0.0084g. Desire sample ash content is 0.0104g. As per methods of (AOAC- 940.26) , the sample was analysed in laboratory and results are shown:

Table -2: Estimation of Ash of Beetroot sample

Sample	Empty crucible weight	Sample weight g	Last	Results
The sample 3 month ago	22.9941g	2.0098g	23.0044g	0.0103g
The sample 6 month ago	26.9145g	2.0023g	26.9249g	0.0104g
The sample 8 month ago	24.0664g	2.0037g	24.0742g	0.0078g
Process Sample	23.9327g	2.0163g	23.9431g	0.0104g
Commercial Sample	28.7523g	2.0115g	28.7554g	0.0031g
Raw Sample	23.2313g	2.0096g	23.2396g	0.0083g

4.1.3. Brix

As per methods of (AOAC- 932.12) , the sample was analysed in laboratory and results are shown: The average amount of brix in 3 months ago sample: 12.16, The average amount of brix in 6 months ago sample: 11.20, The average amount of brix in 8 months ago sample: 3.97, The average amount of brix in Process sample: 12.50, The average amount of brix in commercial sample: 13.14, The average amount of brix in Raw sample: 5.97.

After averaging all the sample, the brix is 9.8. Desire sample brix content is 12.50.

4.1.4. pH

As per methods of (AOAC- 2005.02) , the sample was analysed in laboratory and results are shown: The average amount of pH in 3 months ago sample: 5.03, The average amount of pH in 6 months ago sample: 4.07, The average amount of pH in 8 months ago sample: 3.93, The average amount of pH in Process sample: 5.89, The average amount of pH in commercial sample: 4.48, The average amount of pH in Raw sample: 6.04.

The average amount of pH in Process sample: 5.89.

4.1.5. Protein

As per methods of (Digestion) , the sample was analysed in laboratory and results are shown:

The average amount of protein in 3 month ago sample: 1.249 (Protein %); 3.568(Volume), The average amount of protein in 6 month ago sample: 1.273 (Protein %); 3.6345 (Volume), The average amount of protein in 8 month ago sample: 0.8315 (Protein %); 2.3755(Volume), The average amount of protein in Process sample: 1.0205 (Protein %); 2.9145(Volume), The average amount of protein in commercial sample: 0.306 (Protein %); 0.874 (Volume), The average amount of protein in Raw sample:: 0.7885 (Protein %); 2.2525 (Volume).

After averaging all the sample, the protein content is 0.9114%, Volume: 2.603. Desire sample protein content is 1.0205 % and volume: 2.9145.

4.1.6. Iron

As per methods of (999.10 AOAC, 2005), the sample was analysed in laboratory and results are shown: The average amount of iron in 3 months ago sample: <dl, The average amount of iron in 6 The average amount of iron in process sample: months ago, sample: <dl, The average amount of iron in 8 months ago sample: 0.88 ppm, <dl, The average amount of iron in commercial sample: <dl, The average amount of iron in Raw sample: <dl.

The average amount of iron in all sample: <dl. The average amount of iron in process sample is also: <dl. In Bangladeshi Beetroot I did not get any iron by the laboratory test. But I got iron for 1 sample which was cultivate in winter, but it was a very small amount.

4.1.7. Potassium

As per methods of (AOAC-985.35, 2005), the sample was analysed in laboratory and results are shown: The average amount of K in 3 months ago sample: 1960.59 ppm, The average amount of K in 6 months ago sample: 2356.44 ppm, The average amount of K in 8 months ago sample: 1838.01 ppm, The average amount of K in process sample: 1694.30 ppm, The average amount of K in commercial sample: 583.51 ppm, The average amount of K in Raw sample: 1446.49 ppm.

After averaging all the sample, the K content is: 1646.56 ppm. Desire sample K content is: 1694.30 ppm. K content is: 1694.30 ppm.

4.1.8. Calcium

As per methods of (AOAC-985.35, 2005), the sample was analysed in laboratory and results are shown: The average amount of C in 3 months ago sample: 38.78 ppm, The average amount of C in 6 months ago sample: 44.79 ppm, The average amount of C in 8 months ago sample: 62.62 ppm, The average amount of Ca in process sample: 74.89

ppm, The average amount of C in commercial sample: 111.89 ppm, The average amount of C in raw sample: 64.09 ppm,

After averaging all the sample, the C content is: 66.17 ppm. Desire sample content of K is: 74.89 ppm.

4.1.9. Magnesium

As per methods of (AOAC-985.35, 2005), the sample was analysed in laboratory and results are shown: The average amount of Mg in 3 months ago sample: 106.74, The average amount of Mg in 6 months ago sample:114.62 ppm, The average amount of Mg in 8 months ago sample: 66.57 ppm, The average amount of Mg in process sample: 46.01 ppm, The average amount of Mg in commercial sample: 10.27 ppm, The average amount of Mg in Raw sample: 54.16 ppm.

After averaging all the sample, the Mg content is: 66.69 ppm. Desire sample content of Mg is: 46.01 ppm

4.1.10. Sodium

As per methods of (AOAC-985.35, 2005), the sample was analysed in laboratory and results are shown: The average amount of Na in 3 months ago sample: 974.44 ppm, The average amount of Na in 6 months ago sample: 924.10 ppm, The average amount of Na in 8 months ago sample: 724.37 ppm, The average amount of Na in process sample: 1413.44 ppm, The average amount of Na in commercial sample: 376.04 ppm, The average amount of Na in Raw sample: 1245.84 ppm.

After averaging all the sample, the Na content is: 943.03 ppm. Desire sample content of Na is: 1413.44 ppm.

4.1.11. Vitamin-C

As per methods of (AOAC-967.21, 2005), the sample was analysed in laboratory and results are shown: For all sample it's detection limit was 5 ppm.

After averaging all the sample, the Na content is: 5 ppm. Desire sample content is: 5 ppm.

B. Microbiological Assay

4.2. Microbiological Test

As per methods of (AOAC: 991.14), the sample was analysed in laboratory and results are shown: E-coli test using of EMB agar, for total plate count using nutrient agar, for fungus SDA agar.

4.2.1. Sample 1, 2, 3 (Raw, final, commercial Sample): Here did not get any E-coli here.

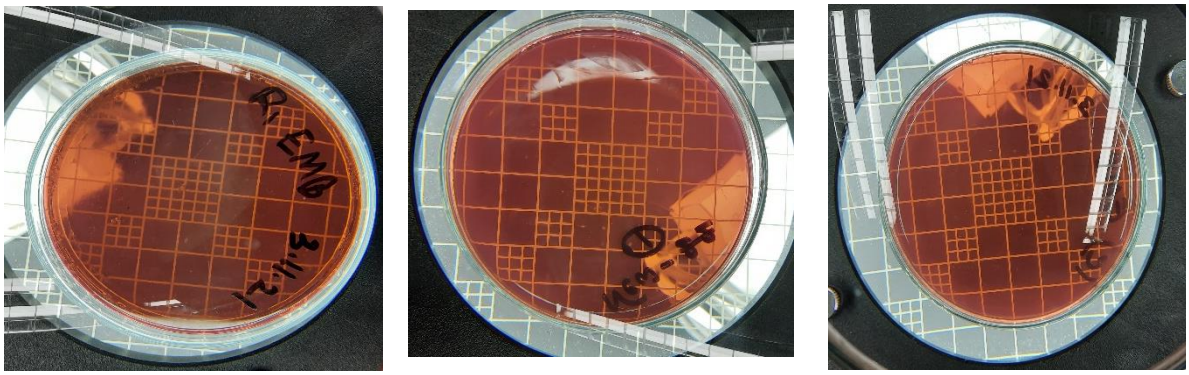

Figure 10: E-coli determination plate

4.2.2. Sample 4, 5, 6 (3, 6, 8-month Sample): Here did not get any E-coli here.

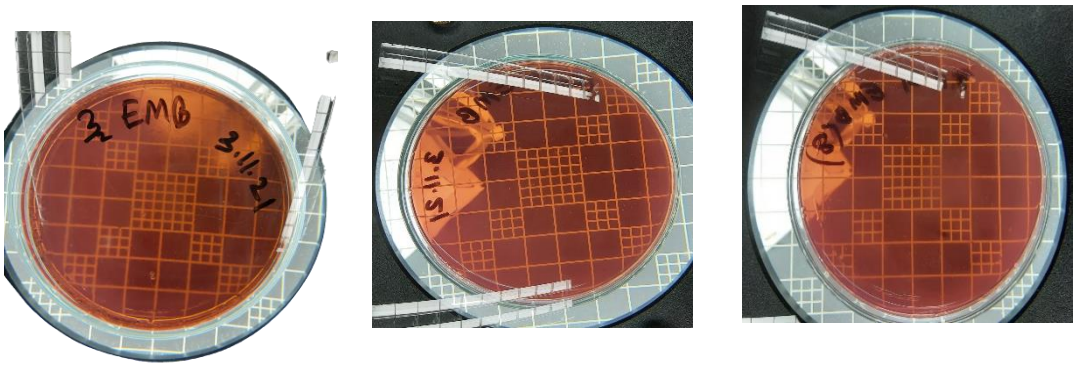

Figure 11: E-coli determination plate

4.2.3. Sample 1, 2, 3 (Raw, final, commercial Sample): In this plate did not get any bacteria here.

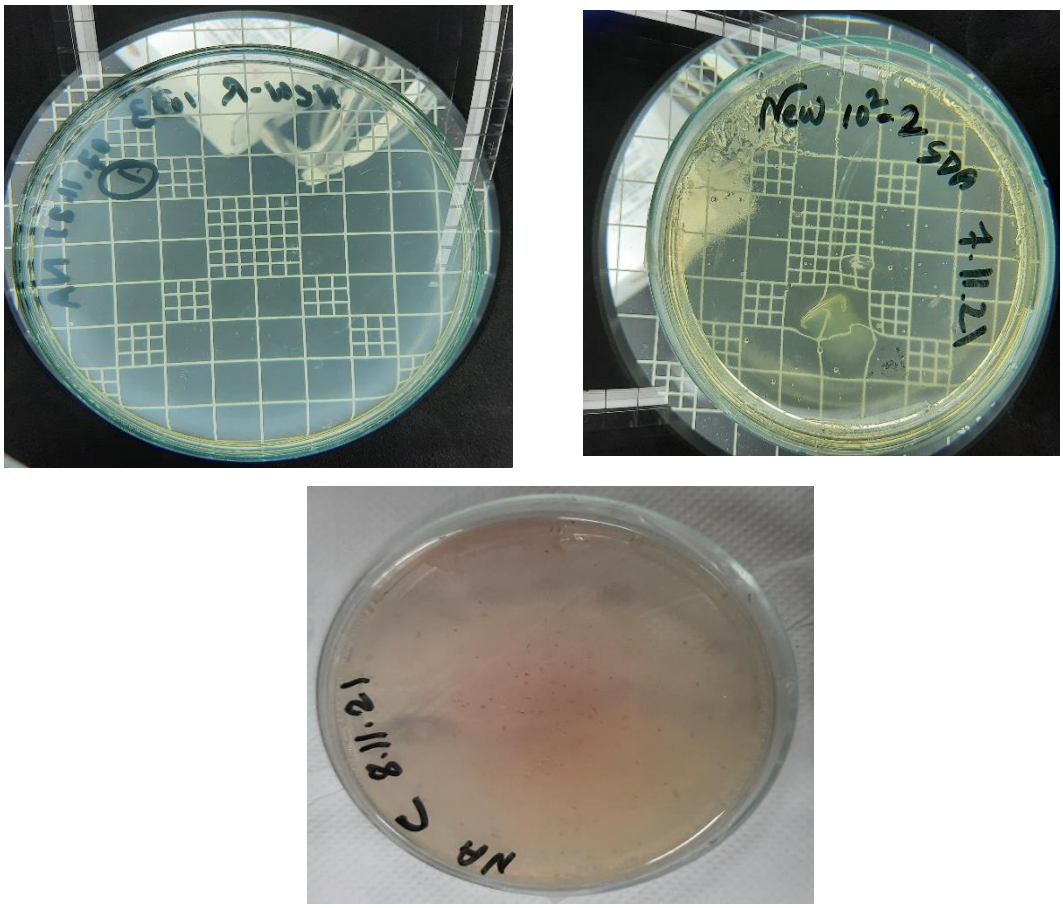

Figure 12: Bacteria determination plate

4.2.4. Sample 4, 5, 6 (3, 6, 8-month Sample): After this test did not get any bacteria here.

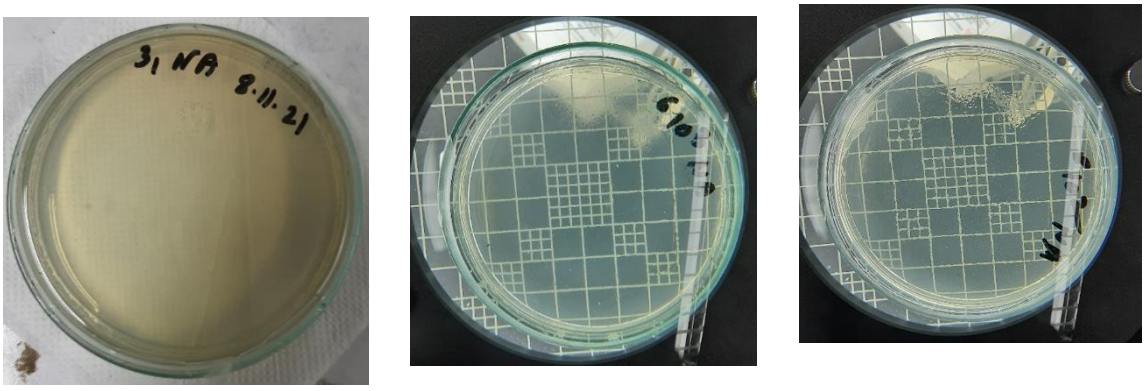

Figure 13: Bacteria determination plate

4.2.5. Sample 1, 2, 3 (Raw, final, commercial Sample): Here did not found any fungus, mold here.

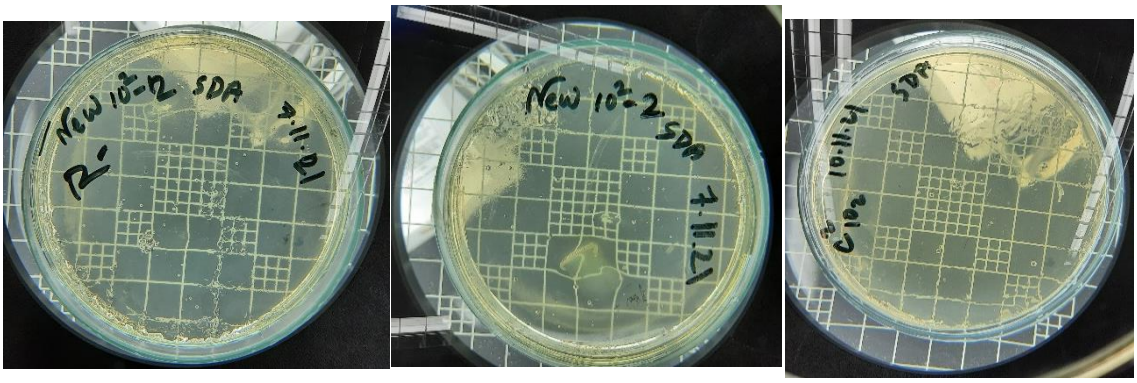

Figure 14: Fungus and mold determination plate

4.2.6. Sample 4, 5, 6 (3, 6, 8-month Sample): Here found significant amount of fungus, mold here.

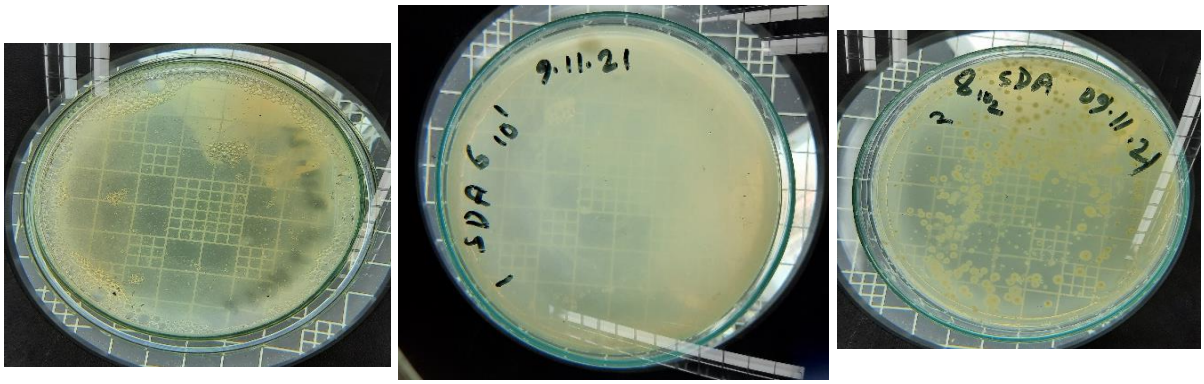

Figure 15: Fungus and mold determination plate

C. Data of effect for beetroot sample among selected volunteers

4.3. Beetroot Juice Survey Form (A)

Dear participants, the following form is designed to receive your valuable feedback regarding the Beetroot Juice effectiveness on female during their menstruation. The aim of the research is to develop Beetroot Juice which will reduce the menstrual complications and women will feel fresh and energetic during their menstrual days.

This survey will truly use for academic and research purposes only. Your voluntary participation is greatly appreciated.

1. Your Name *
2. Your mail address *

3. Contact number *
4. Your Age *
5. Occupation *
    i) Student
    ii) Housewife
    iii) Professional
    iv) Business/Entrepreneur
6. Menstruation date during this month? *
7. How much do you prefer to drink juice? *
    i) Very fond of
    ii) Favorite
    iii) Moderate
    iv) Not at all
8. When do you often drink the fruit juices? *
    i) Feeling Thirsty
    ii) Celebration
    iii) Medication
    iv) Without any reason
    v) To feel fresh
9. What factors usually you consider during buying a fruit juice? *
    i) Price
    ii) Nutrition Value
    iii) Quality and Standard
    iv) Taste
    v) Varieties Medication
10. Do you know about beetroot juice? *
    i) Yes
    ii) No
11. Do you often drink beetroot juice? *
    i) Yes
    ii) No
    iii) Other
12. Did you know about beetroot juice before consuming it? *
    i) Yes
    ii) No
13. When did you drink it? *
    i) Before menstruation
    ii) During menstruation
    iii) Immediate before to menstruation
    iv) Without menstruation
14. How much quantity of juice did you drink? *
    i) 250 ml
    ii) 300 ml
    iii) 500 ml
    iv) 750 ml

15. How long have you been drinking it? *
    i) 1day
    ii) 1-2 days
    iii) 1-3 days
    iv) 1-4 days
16. How much quantity did you drink in a single sip? *
    i) 10ml
    ii) 20ml
    iii) 30ml
    iv) 50ml
17. How much quantity did you drink in a single sip?
    i) 10ml
    ii) 20ml
    iii) 30ml
    iv) 50ml
18. How many times did you drink in a single day? *
    i) 1 time
    ii) 2 times
    iii) 3 times
    iv) 4 times
19. How was the color of beetroot juice? *
    i) Purple
    ii) Dark red
    iii) Orange red
    iv) Red
    v) Other
20. How was the flavor of beetroot juice? *
    i) Slightly Tolerable
    ii) Tolerable
    iii) Pleasant
    iv) Very attractive
    v) Other
21. How was the taste of the beetroot juice? *
    i) Sweet
    ii) Bitter
    iii) Sweet and Bitter
    iv) Sour
22. Did you feel fresh and energetic after drinking it? *
    i) Yes
    ii) No
    iii) Other
23. Have you had below complications during menstruation period? Please select your level of complications. *
    Low Moderate High
    i) Vomiting
    ii) Pain

iii) Hormonal Problem
iv) Back or Leg pain
v) Itching
vi) Reluctance to eat
vii) Mood swings

24. How was much your menstruation pain reduced after drinking beetroot juice? *
    i) Slightly
    ii) Moderately
    iii) Totally
    iv) Not at all
25. When did your pain was reduced after drinking beetroot juice? *
    i) Within 1 hr.
    ii) 1-2 hr.
    iii) 2-3 hr.
    iv) 3-4 hr.
    v) 4-5 hr.
26. Have you taken any medicine during menstruation while drinking beetroot juice? *
    i) Yes
    ii) No
27. What are the benefits you have noticed in beetroot juice?
    i) Reduce pain
    ii) Glowing skin
    iii) Reduce headache
    iv) Feel energetic
    v) Reduce
    vi) other complication
    vii) Sound sleep
28. How long you are drinking beetroot juice? *
    i) 1 month
    ii) 2 months
    iii) 3 months
    iv) More than 3 months
29. What are the typical treatments you have undergone during your menstrual symptoms? *
    i) Common pain relievers
    ii) Prescribed pain relievers
    iii) Traditional remedies
    iv) Hot baths
    v) Meditation
    vi) Exercise
    vii) Excess sleep or rest
    (viii) Any herbal drinks
30. Did you take any medicine after drinking beetroot juice or beetroot juice cure the complications? *

i) Yes, I took another medicine too
ii) No, I don't take any medicine
iii) Beetroot juice cure my complications
iv) Other:

31. How was the menstrual blood flow after drinking beetroot juice? *
    i) Normal
    ii) Very fast
    iii) Clotting
    iv) Reduce excessive flow
    v) Other
32. Did you notice any of the below effects after drinking beetroot juice? *
    i) Headache
    ii) Vomiting
    iii) Anxiety
    iv) Lack of concentration
    v) Sleepy
33. Do you believe beetroot juice is very useful for girls and women? *
    i) Yes
    ii) No
34. Will you drink beetroot juice repeatedly during menstruation in future? *
    i) Yes
    ii) No
    iii) Maybe
35. Do you think beetroot juice shall be used widely as potential health drink for women during menstruation? *
    i) Yes
    ii) No
    iii) Maybe
36. Can we use beetroot juice as a regular health drink? *
    i) Yes
    ii) No
37. What type of packaging for beetroot juice you will prefer? *
    i) Pouch
    ii) Glass bottle
    iii) PET bottle
    iv) Plastic bottle
38. Which flavor you consumed? *
    i) Grapes
    ii) Strawberry
    iii) No flavor
    iv) Other
39. If you have any comment about beetroot juice, please share for continuous improvement of the quality and standard of this juice.

Thank you very much for cooperating me

4.4. DATA of Survey of the effect of Beet Root Juices among participants' Women(B)

A survey was conducted after drinking the beetroot juice during their menstruation period and the obtained data was:

There was general question before drinking beetroot juice like how much the prefer to drink juice? Here, found that everyone likes it. There are very few volunteers who dislike juice. Most of the volunteers said it is favorite to them, then some volunteers said very fond of to them, and others said it is favorite to them.

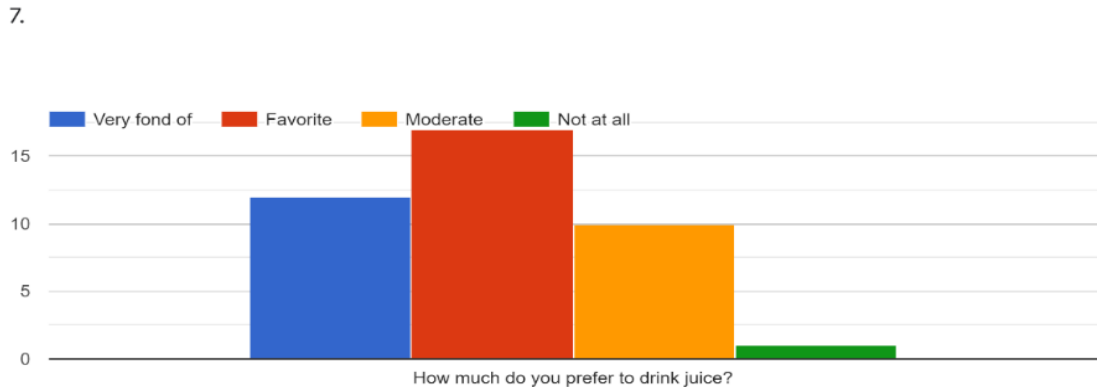

Figure 16: Questionnaire model - 07

There is a question. When do you often drink the fruit juice? The result is like most of the people drink juice without any reason, some are drunk to feel fresh, some are for medication, some are for celebration, and some are drink when they feel thirsty.

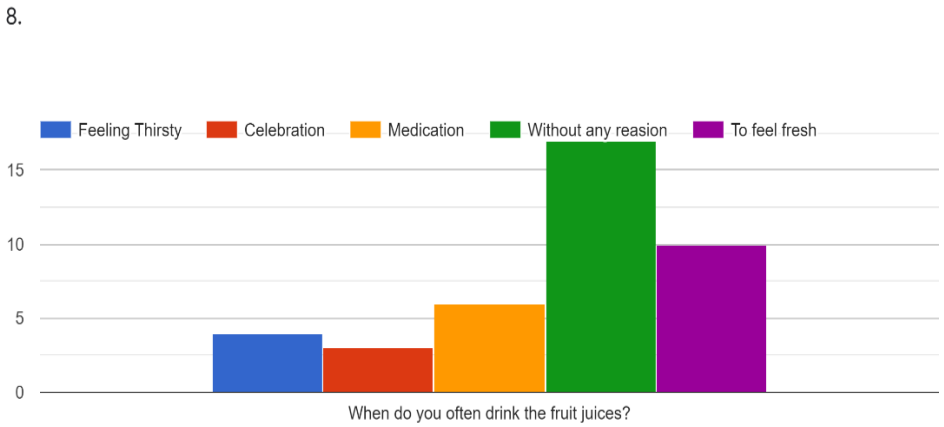

Figure 16: Questionnaire - 08

According to survey when females buy juice, they firstly follow the nutrition value, then taste, then quality.

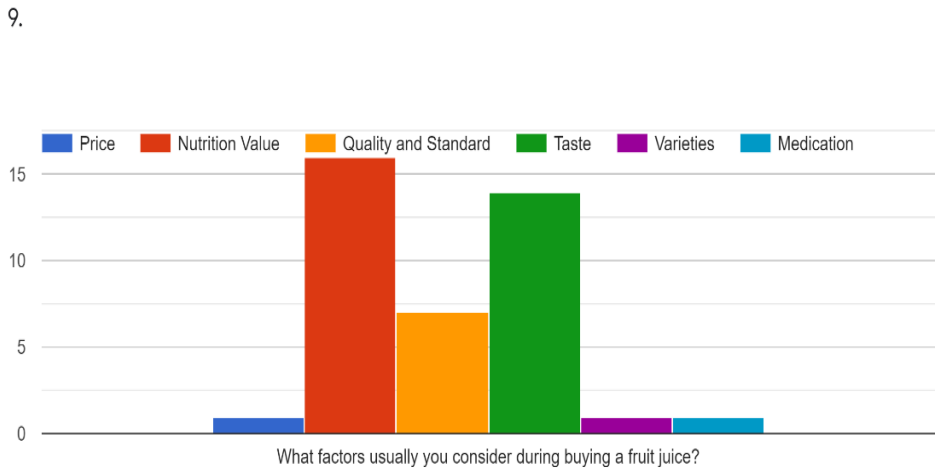

Figure 18: Questionnaire 09

When asked them if they knew about beetroot juice? Then they replied that they knew about this before and everyone who took part in this survey all are knew about the juice.

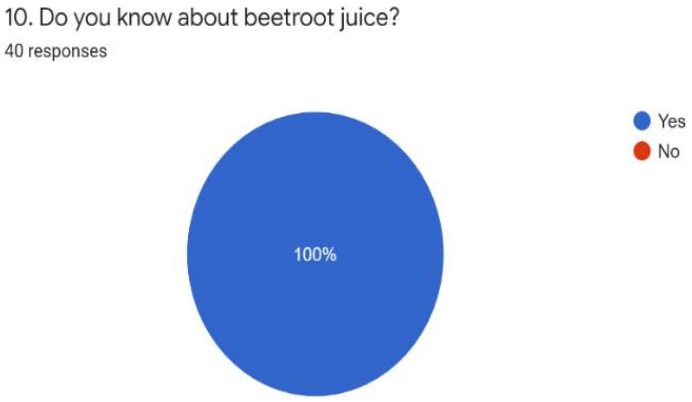

Figure 19: Questionnaire 10

When I asked, do you often drink beetroot juice? The 50% girls said they drink it. 42.5% not to drink it, 7.5% said they sometimes drink it.

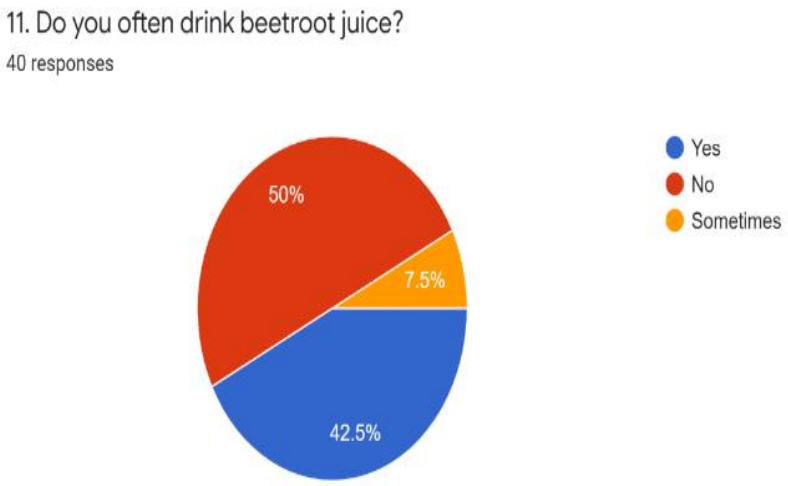

Figure 20: Questionnaire 11

50% Female are consuming beetroot juice before and 50% are not.

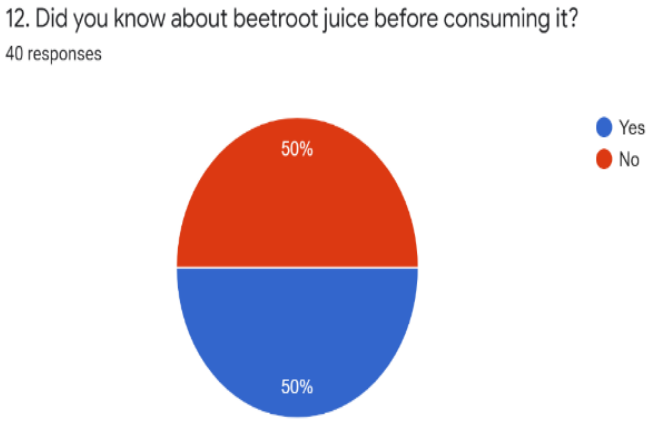

Figure 21: Questionnaire 12

Most of woman's drunk beetroot juice immediate before to menstruation. Some are drunk before menstruation, some drunk during menstruation, Some drunk without menstruation.

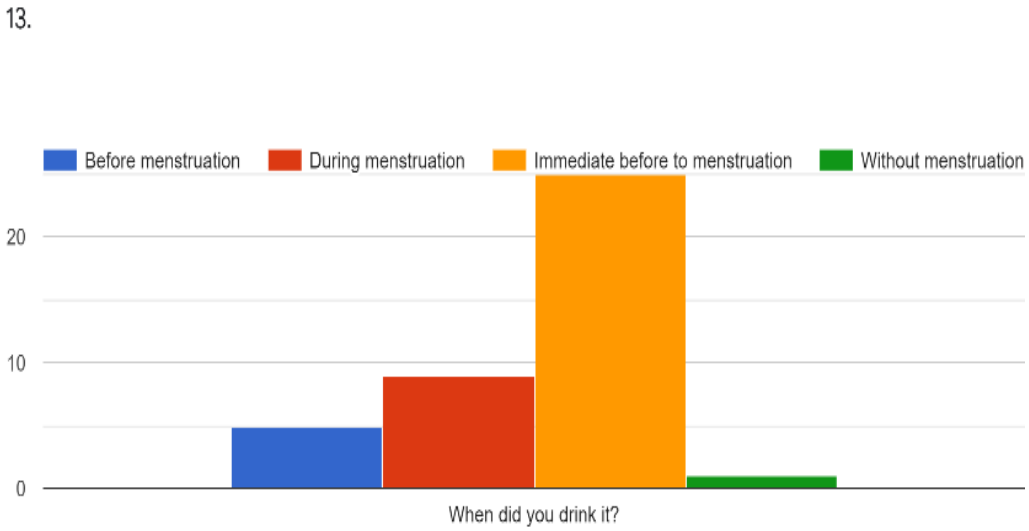

Figure 22: Questionnaire 13

Most of the woman's drunk 250ml juice during their period, some are drunk 500ml, some are 300ml, and some are drunk 750ml.

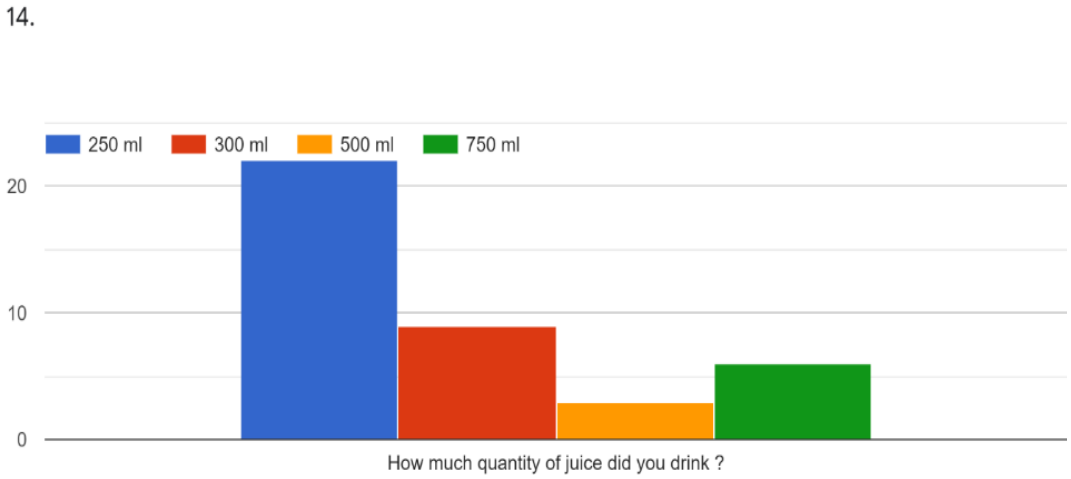

Figure 23: Questionnaire 14

Large number of woman's drunk juice 1-3 days during their menstruation. Very small number of people are drunk 1-4 days. Very few are drunk 1-2 or 1 days

Figure 24: Questionnaire 15

Most of the Females are 10ml drunk in a single sip. Some are dunk 20ml and then few females are drunk 30ml in a single sip.

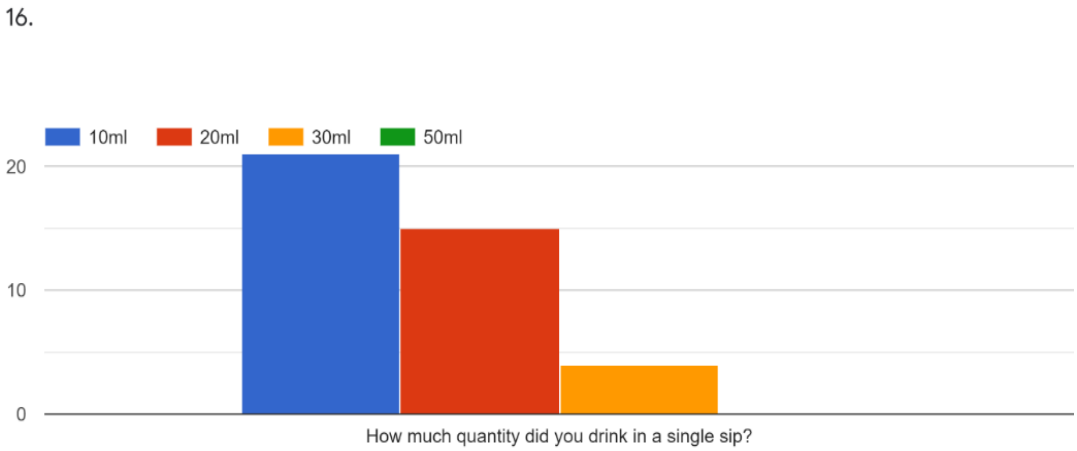

Figure 25: Questionnaire 16

Most of the girls drunk it 3 times in a single day. Few girls are drunk 2, 1or 4 times in a day.

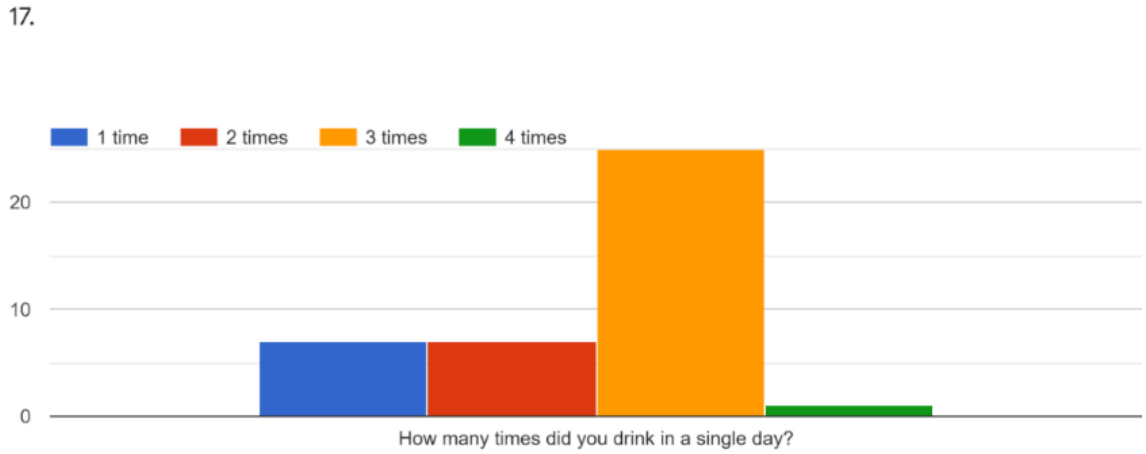

Figure 26: Questionnaire 17

67.5% volunteers said this juice color is purple, 25% are dark red, according to 7.5% red.

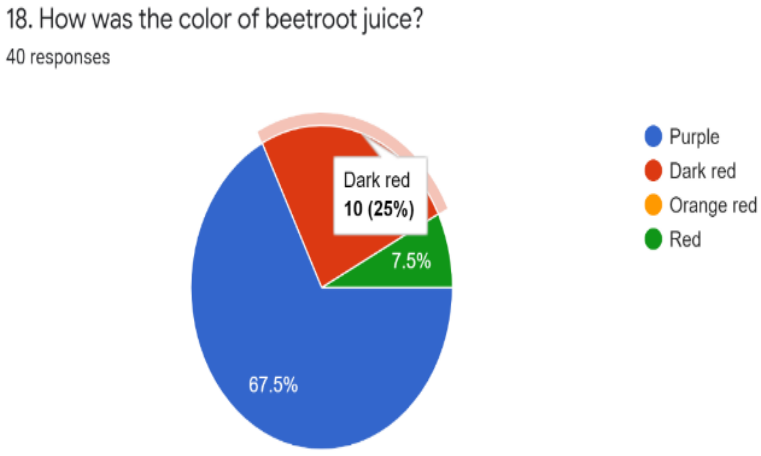

Figure 27: Questionnaire 18

Beetroot flavor is like starchy and soil type smell. But after survey 62.5% girls said it was tolerable, 25% said slightly tolerable, 12,5% said it was pleasant.

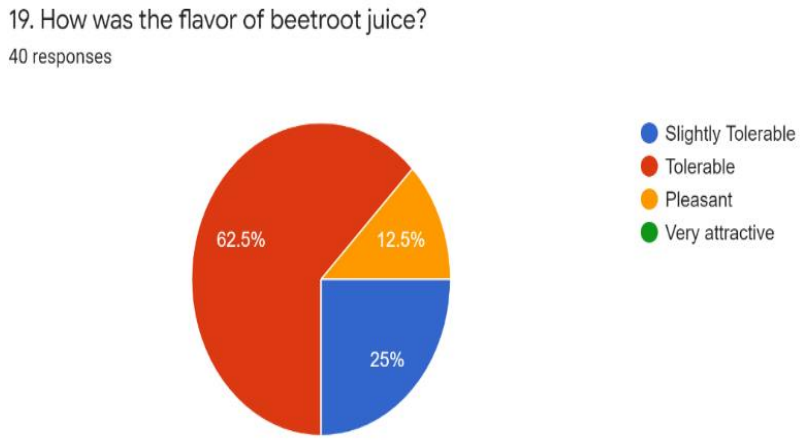

Figure 28: Questionnaire 19

According to the survey report 47.5% said that Beetroot juice was sweet and bitter, 12,5% said bitter, and 37.5% said that it was sweet.

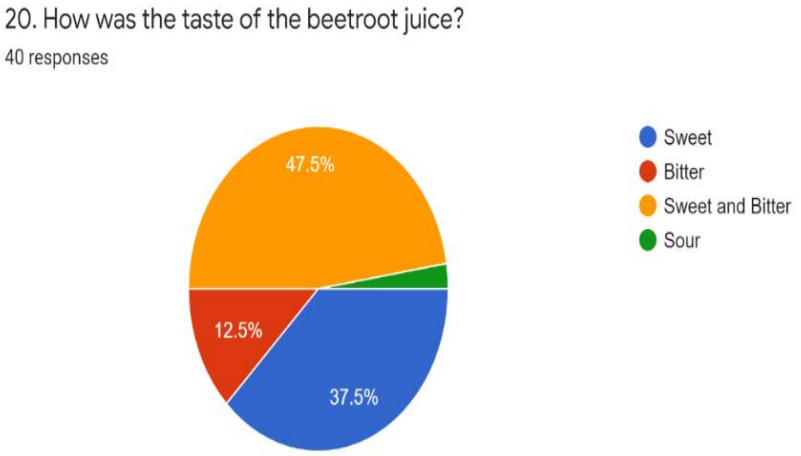

Figure 29: Questionnaire 20

I asked them after drinking it how was the feelings fresh, energetic, or no? 82.5% said yes and only 12.5% answered no.

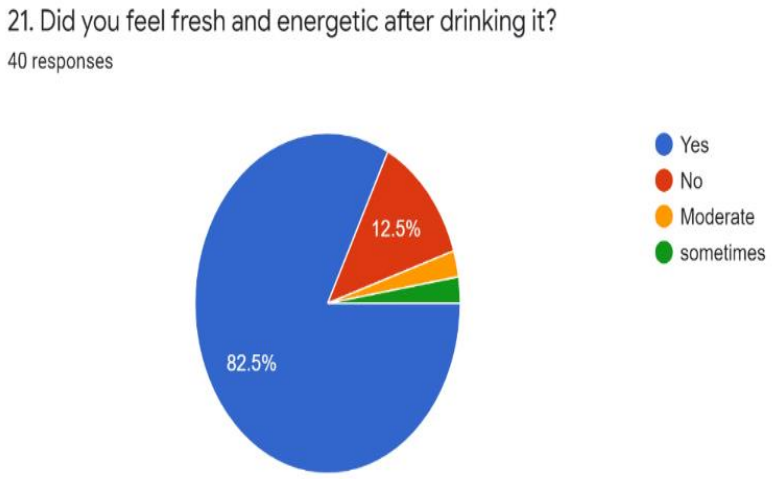

Figure 30: Questionnaire 21

These complications are felt almost all the girls during menstruation. What is shown here is that some people feel too much of a complication and some feel a little less. But vomiting, abdominal pain, reluctance to eat mood swing are seen a little more here.

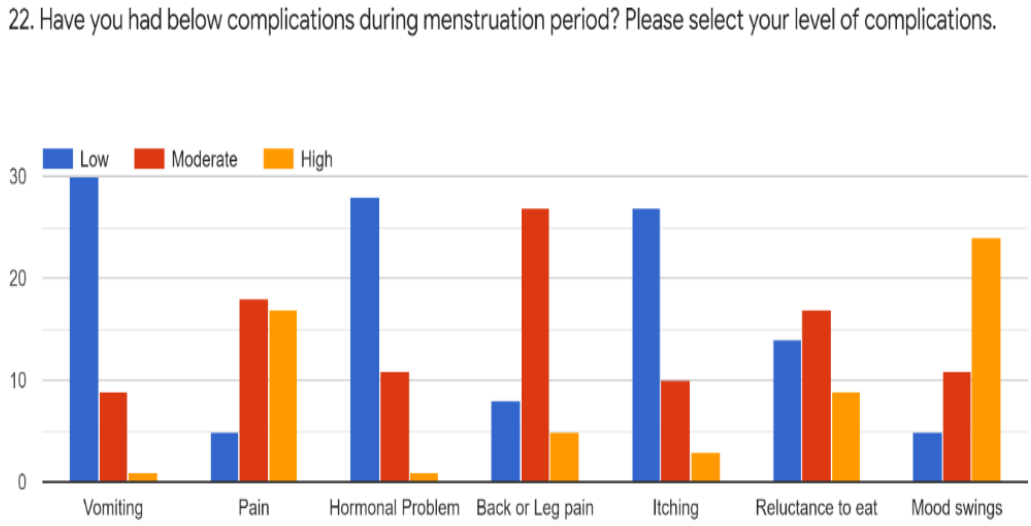

Figure 31: Questionnaire 22

After drinking beetroot juice, 67.5% said that our pain relievers moderately and 20% said slightly and 10% said it was work totally.

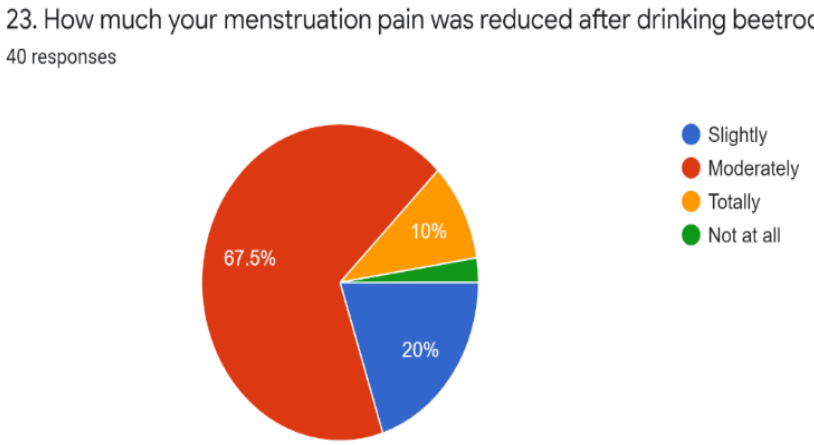

Figure 32: Questionnaire 23

According to this survey I can see that after drinking beetroot juice many girls claim that from 1-2 hr. pain removed.

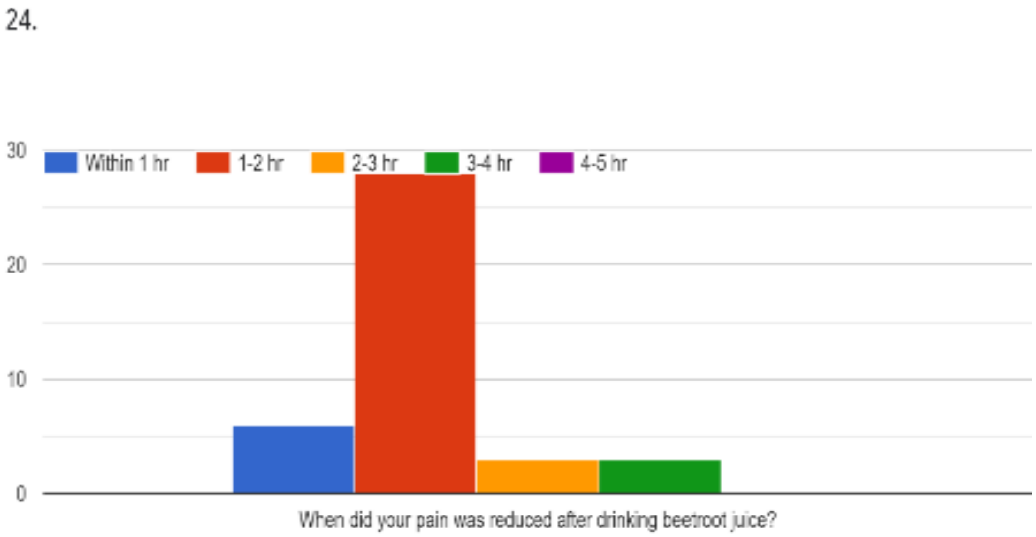

Figure 33: Questionnaire 24

According to this graph I see that after drinking beetroot juice 52.5% girls did not use another medicine.

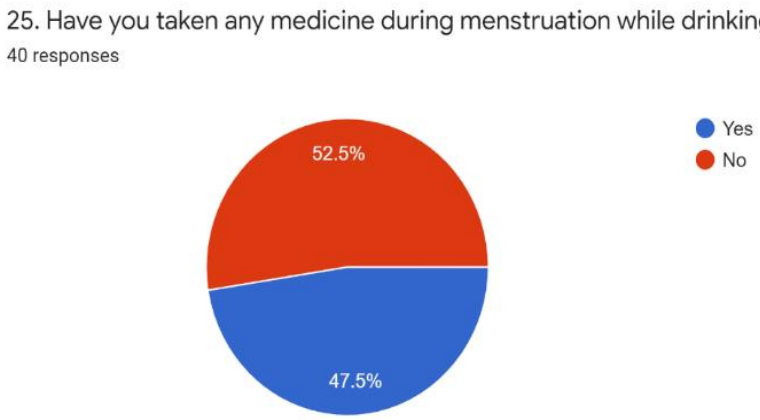

Figure 34: Questionnaire 25

I have noticed the benefits of beetroot juice is reduce abdominal pain, at the same time it is good for skin and energetic.

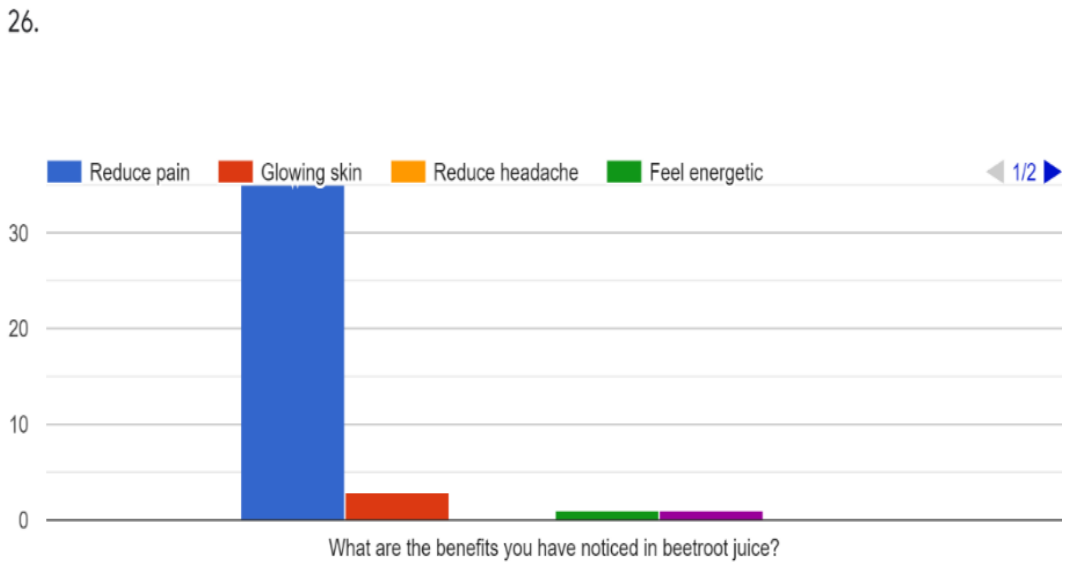

Figure 35: Questionnaire 26

Here 45% girls are drink juice for 1 month, 12.5% drink for 3 months and 37.5 % drinking for 2 months.

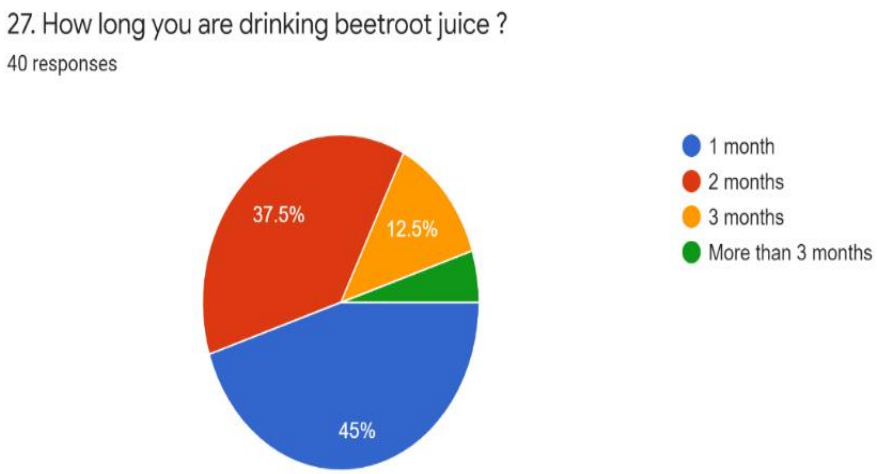

Figure 36: Questionnaire 27

There are many types of treatment for menstruation complication reductions 22% are take rest and sleep, 15% take hot baths, 25% take pain killer prescribed by a doctor, 17.5% use common pain relievers, 10% take meditation.

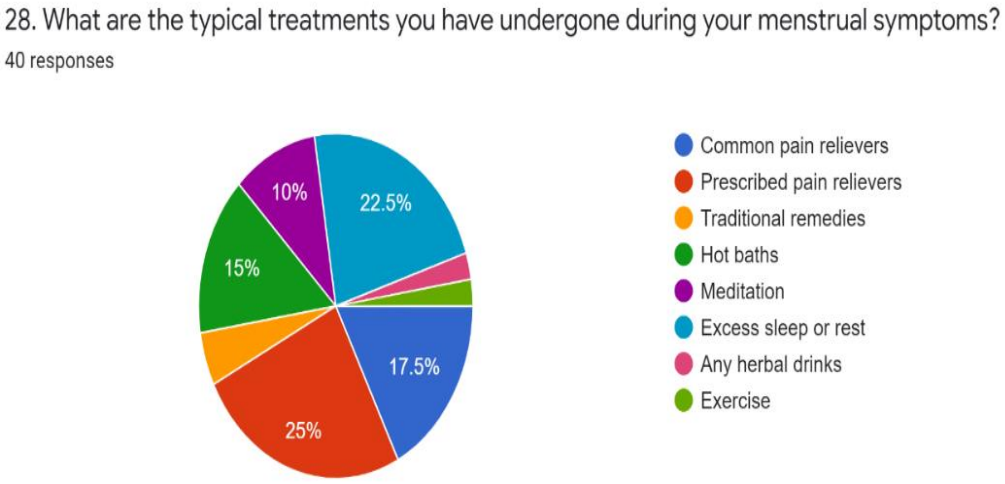

Figure 37: Questionnaire 28

After drinking beetroot juice 55% did not take any medicine. 27.5% said that beetroot juice cures their complications. 17.5 % only take medicine.

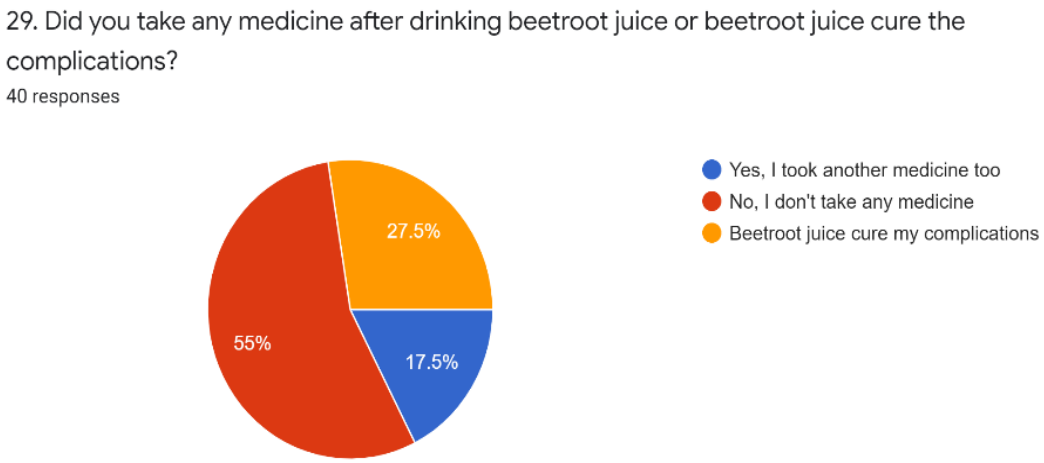

Figure 38: Questionnaire 29

After drinking beetroot juice 80% blood flow was normal than before, 10% has clotting and 10% reduce excessive flow.

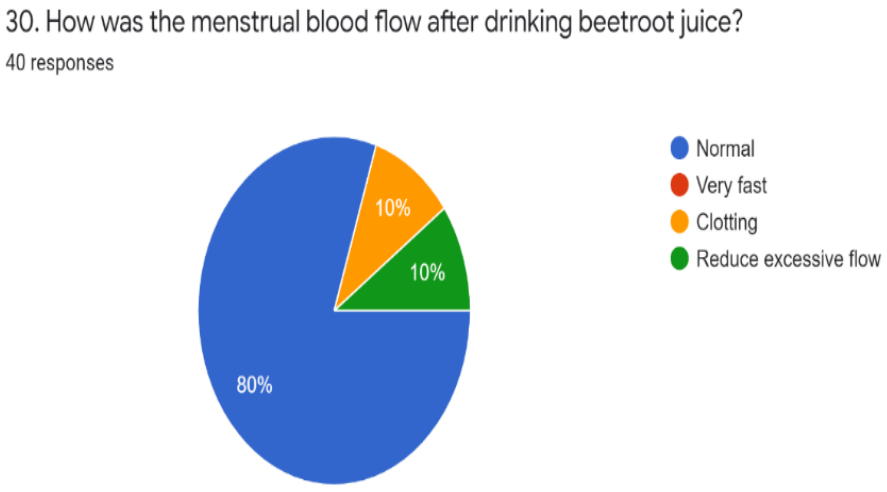

Figure 39: Questionnaire 30

After drinking beetroot juice 30% felt lack of concentration, 20% felt sleepy, 15 felt headache, 32.5% felt vomiting.

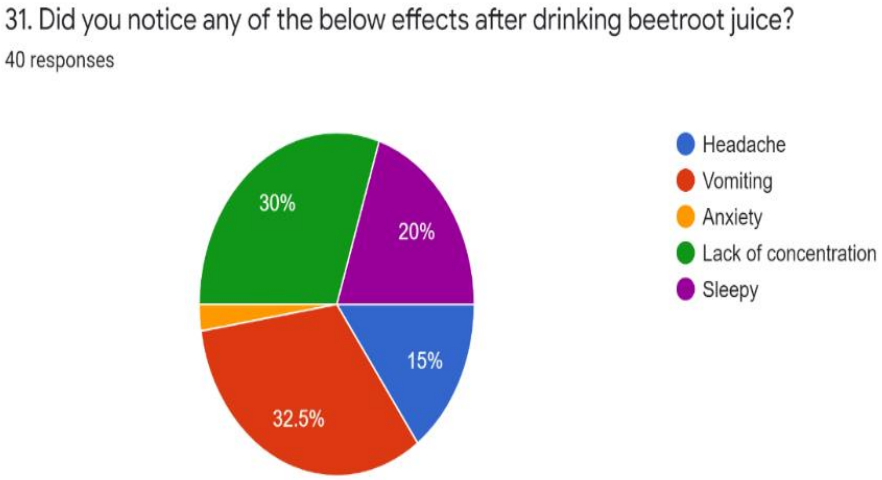

Figure 40: Questionnaire 31

Everyone believes that beetroot is very useful for girls and women.

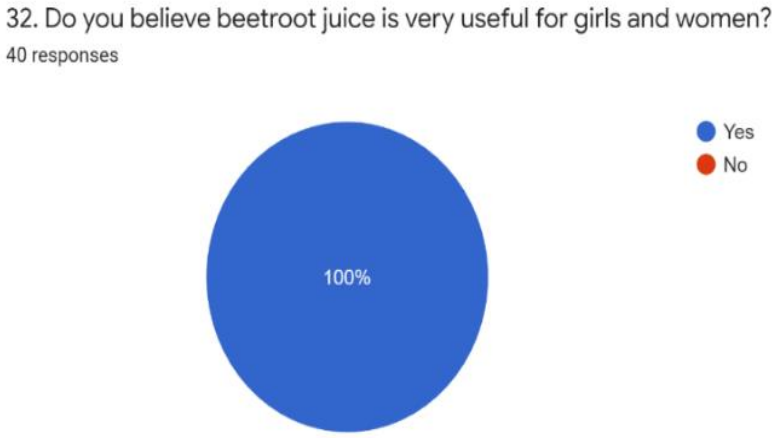

Figure 41: Questionnaire 32

65% females drink this juice in future during their menstruation.

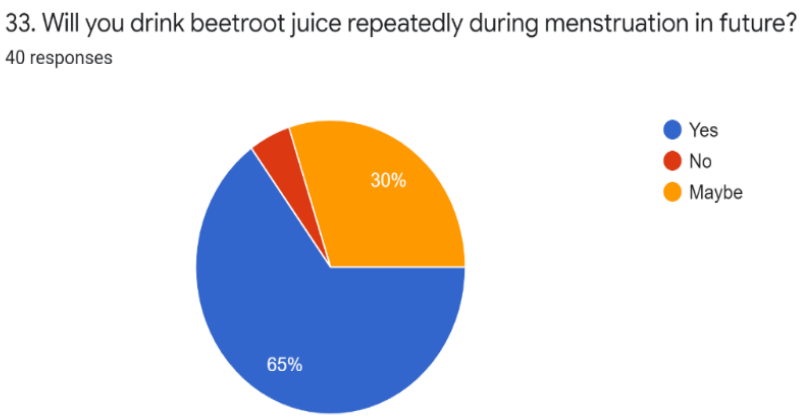

Figure 42: Questionnaire 33

62.5% think that beetroot juice will be used widely as a potential health drink during menstruations. And 37.5 % are think that may be beetroot juice will be used widely as a potential health drink during menstruations.

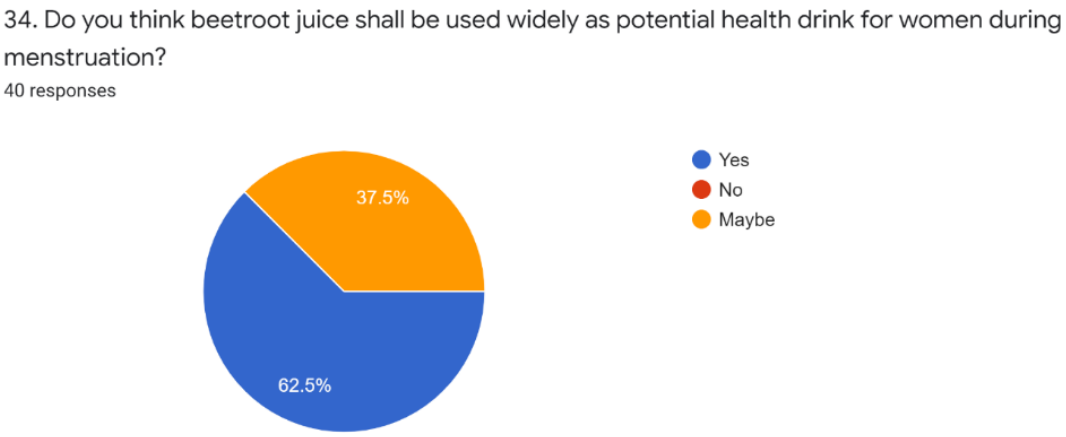

Figure 43: Questionnaire 34

65% said we can use beetroot as a regular health drink.

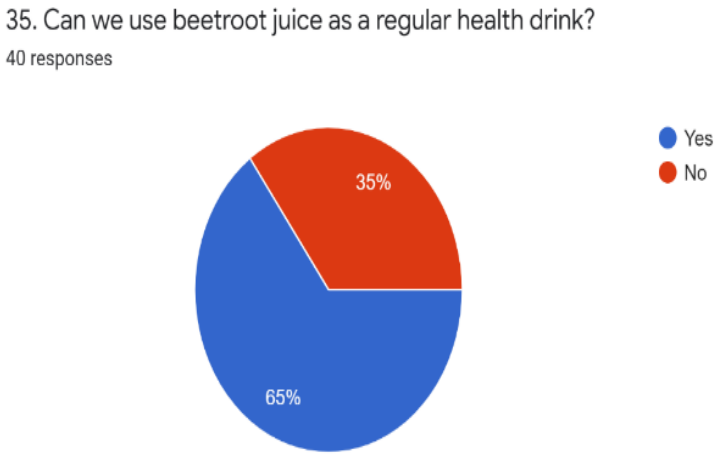

Figure 44: Questionnaire 35

30% choice plastic bottle for packaging, 35% said glass bottle for packaging, 7.5% want pouch and 27.5% said PET bottle.

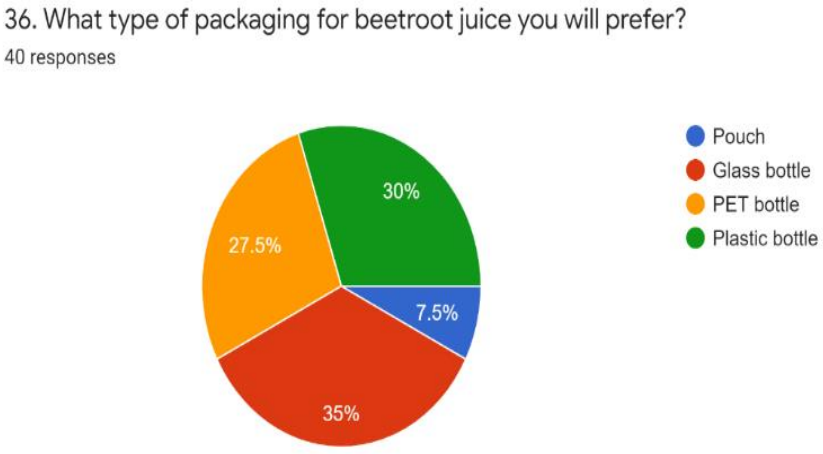

Figure 45: Questionnaire 36

65% choice strawberry flavor for this juice.

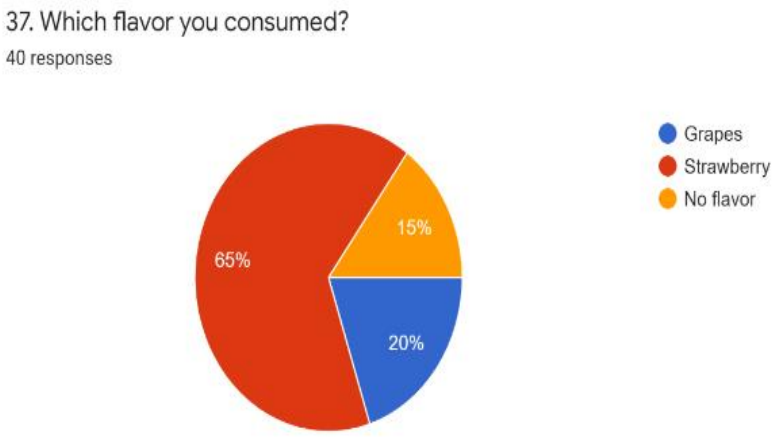

Figure 46: Questionnaire 37

4.5. Sensory Acceptability of Products

Survey response is good. Some females comment beetroot juice is helpful. It is very healthy. Some have an interest to use further. Some of them have asked to improve the test and flavor. Overall response was initiative.

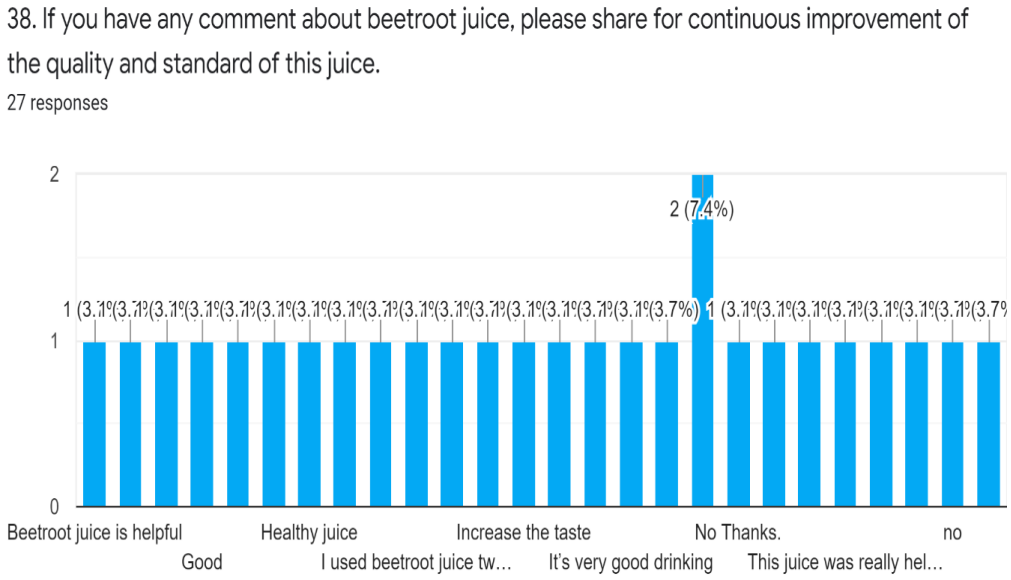

Figure 47: Questionnaire 38

CHAPTER FIVE

CONCLUSION

This thesis was carried out to produce beetroot juice as women health drinks. My purpose was developed beetroot juice for preventing menstrual cramps. It has been thoroughly tested in the laboratory to see how much health benefits it has, and good results have been found after the test. After the test in this juice ash content is 0.0104g. Moisture content is 0.2043g, Brix content is 12.50, pH 5.89, Protein content is 1.0205 % and volume: 2.9145. Potassium content : 74.89 ppm, Magnesium content: 46.01 ppm, Sodium Content: 1413.44 ppm, Iron content: 66.17 ppm and Vitamin C content: 5 ppm. All thing are very essential for health and it can reduce the excecive menstrual copmlcations. After survey result I got 100% girls said its very healthy and work nichly. And 65% women want to drink again. Its really very useful for our country adolocent girls. If I can introduced this juice globally every girls are beneficial from this.

CHAPTAR SIX

FUTURE PLAN

The future with this project is that I want to bring this juice to the market as a health drink. That's why I want to fortify it by using something which has huge amount of health benefits like Vitamin D, Zinc etc. The amount of iron is less in Bangladeshi beetroot so some amount of iron I want to add with it. If it can be brought to market properly, then it will play a significant role in the health of women in our country and around the world.

CHAPTER SEVEN

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