IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Study On Consumption Of Whole Foods Vs Processed Foods In Relation With Anemia

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Abstract: It is a comparative study conducted among adolescent girls of age 18-23yrs. A sample size of 100 was selected to analyze their dietary habits and corresponding hemoglobin levels. The objective is to evaluate the intake of whole foods versus processed foods in relation to individual hemoglobin levels. Additionally, the study aims to examine the correlation between the consumption of whole foods and processed foods and their impact on hemoglobin levels.

***Index Terms* - Whole Foods, Processed Foods, Hemoglobin**

I. INTRODUCTION

1. WHOLE FOODS

Whole foods are either not processed or processed minimally like whole grains, legumes, and fresh fruits, which are close to their natural state. They contain a myriad of vitamins, minerals, phytochemicals, and other nutrients in the outer (bran) and inner (germ) layers (1). The bran and germ are both removed during the refining process, which makes refined grains more energy-dense but less nutrient-rich. Adults' higher consumption of whole-grain foods is associated with improved consumption of nutrients, dietary components, and overall diet quality (2–4). These tend to be nutrient-dense which means they are filled with vitamins, minerals, and fibre and don't have added sugar, sodium, or unhealthy fats such as trans-fat.

1.1 Plant-based whole foods

A plant-based whole food is based on vegetables, fruits, legumes, nuts, seeds, and whole grains. These foods contain proper vitamins and nutrients such as potassium, vitamin C, and folate to nourish and keep your body healthy.

a. Vegetables: carrots, tomatoes, potato, brinjal, lady's finger
b. Fruits: apples, bananas, mangoes, peaches, lemons, figs
c. Legumes: black beans, chickpeas, soya beans, kidney beans, lentils
d. Nuts and seeds: almonds, walnuts, cashew nuts, pistachios, sunflower seeds, pumpkin seeds
e. Whole grains: brown rice, quinoa, buckwheat, whole rye, rolled oats, corn

1.1f. Millets

Millets are recognized as being naturally rich in iron, their nutrient composition varies with the type, variety, and growing conditions. Non-haem iron (plant-based) is not absorbed as readily as haem iron (animal-based) in the presence of phytate and tannin in millets. Most of the cereals such as wheat flour, brown rice, and barley contain phytic acid to levels (5) that are far higher than that of millets. Such as: jowar, bajra, ragi, foxtail.

2. PROCESSED FOODS

Processed foods are foods that have undergone substantial modification, transforming them away from their original form. This process strips them of nutrients, bleaches them, and combines chemicals, and other unnatural additives. As a result, the look, feel, and the taste is different from their natural form. Food processing can be as basic as baking, freezing, canning and drying. To understand the food processing, researchers have separated foods into four categories based on the extent of processing:

NOVA, a food classification system developed by researchers at the University of Sao Paulo, Brazil (1, 2):

• **NOVA Group 1:** Minimally processed and unprocessed foods. Vegetables, fruits, grains, beans, and nuts fall into this category. These foods may have gone through roasting, boiling, or pasteurisation to increase shelf life or make them safe to eat.

• **NOVA Group 2:** Processed culinary ingredients obtained directly from group 1 foods or nature. This can include foods such as olive oil, maple syrup, and salt. Group 2 foods are mainly used in the preparation and cooking of group 1 foods.

• **NOVA Group 3:** Processed foods, including items made by adding ingredients like salt, sugar, or other substances from group 2 to group 1 food. Examples include fresh bread, fruits in syrup, and cheese.

• **NOVA Group 4:** Ultra-processed foods. These contain little, if any, of the foods or ingredients from group 1. These items are meant to be convenient, hyper-palatable, and low cost and are typically high in sugars, refined grains, fats, preservatives, and salt.

2.1. Ultra-processed foods

This type of food typically contains substances you wouldn't use in food preparation at home.

Ultra-processed foods have ingredients like

- Artificial colorings and flavourings
- Thickeners and preservatives
- Hydrolyzed proteins
- Sweeteners such as fructose, high fructose corn syrup, invert sugar, and maltodextrin
- Hydrogenated or interesterified oils
- Bulking, foaming, and gelling agents
- Flavour enhancers such as monosodium glutamate (MSG)

Common examples of ultra-processed foods:

Sugary beverages such as carbonated soft drinks, sugary coffee drinks, energy drinks, and fruit punch.

- Sweet or savoury packaged snacks such as chips and cookies
- Sweetened breakfast cereals such as Kellogg's Chocos, Cornflakes, and sweetened oat meals
- Baking mixes such as stuffing, cake, brownie, and cookie mixes
- Reconstituted meat products such as hot dogs and fish sticks
- Frozen meals such as pizza and TV dinners
- Powdered and packaged instant soups
- Candies and other confectionery
- Packaged bread and buns
- Energy and protein bars and shakes
- Meal replacement shakes and powders meant for weight loss
- Boxed pasta products
- Ice cream, sweetened yoghourt, and cocoa mixes
- Margarine and other ultra-processed spreads such as sweetened cream cheese

Not all processed foods are unhealthy but some processed foods may contain high levels of salt, sugar, and fat.

Examples of common processed foods include: Breakfast cereals, cheese, tinned vegetables, bread, savoury snacks such as crisps, sausage rolls, pies, and pasties, meat products, such as bacon, sausage, ham, salami and paté, microwave meals or ready meals, cakes and biscuits, drinks, such as milk or soft drinks.

Not all processed food is a bad choice as some foods need processing to make them safe, such as milk, which needs to be pasteurised to remove harmful bacteria. Other foods need processing to make them suitable for use, such as pressing seeds to make oil. Ingredients such as salt, sugar, and fat are sometimes added to processed foods to make their flavour more appealing and to extend their shelf life, or in some cases to contribute to the food's structure, such as salt in bread or sugar in cakes.

2.2 Highly processed foods

These are far from their natural state and often have sugar, unhealthy fats, sodium, and preservatives added to extend their shelf life. They are energy-dense (lots of calories) but not nutrient-dense and can lead to obesity and chronic disease over time.

Highly processed foods can include: sugary drinks, chocolate and candies, ice cream and frozen desserts, fast foods like French fries and burgers, frozen entrées like pasta dishes and pizzas, bakery products like muffins, buns, and cakes, processed meats like sausages and deli meats.

Eating a diet mainly composed of heavily processed foods, or empty calories supplies us with excessive calories, sugar, fat, and sodium, and tends to be low in fibre and phytonutrients. These can negatively impact our bodies and play a role in the development of obesity, diabetes, hypertension, hyperlipidemia, and certain types of cancer.

3.IRON

Our body needs a wide range of vitamins and minerals to run optimally every day, and that means eating a varied balanced diet rich in whole foods that contain many nutrients. Iron is one nutrient that you need to try to consume every day. Iron is an important mineral that helps maintain healthy blood. A lack of iron is called iron-deficiency anemia.

Our body uses iron to complete a range of metabolic tasks including:

- Aiding in the delivery of oxygen to every cell.
- Aiding in the removal of carbon dioxide from cells to the lungs where it can be exhaled out of the body.
- Supporting metabolic function, growth, and the immune system.
- Producing hemoglobin
- **Improved energy levels:** Iron is responsible for carrying oxygen to our muscles and brain. If one doesn't consume enough iron in the diet, the energy-using efficiency of our body will be affected. It helps improve focus and concentration levels, reduces irritability, and enhances stamina.
- **Enhanced athletic performance:** Proper iron intake is particularly important for individuals who lead an active lifestyle, as it boosts athletic performance. Since iron produces red blood cells that contain hemoglobin, which transfers oxygen to the tissues, its deficiency may lead to poor performance during physical strain.
- **Healthy pregnancy:** During pregnancy, blood volume and red blood cell production increase to make sure that the foetus gets all the necessary nutrients. Thus, the need for iron also increases. Adequate iron intake lowers the risk of premature birth, low birth weight, low iron stores, and cognitive and behavioural deficits in infants. A pregnant woman who consumes iron in her daily diet is less likely to be attacked by a virus and suffer from infections.
- **Boosts the immune system:** Iron plays a major role in strengthening our immune system. It is capable of preventing and treating various health conditions. The red blood cells that it produces are essential for repairing tissue and cell damage and thus, preventing any further issues. Hemoglobin in the red blood cells also boosts your immune system and ensures that it works at optimal levels.
- **Improves cognitive function:** Our brain demands iron for functioning properly, as it requires oxygenated blood for improved cognitive functions. Iron promotes the blood flow in the brain and also helps in creating new neural pathways to prevent cognitive complications, such as dementia and Alzheimer’s disease.
- **Promotes peaceful sleep:** Sometimes we often find ourselves unable to fall asleep at night despite being tired to our core after a long day at work. It might be iron deficient. Before the condition gets out of our hands and becomes harmful to our wellbeing, incorporate iron-rich foods into our regular diet to not only fall asleep easily but also enjoy a deep restorative sleep every night.

Iron depletion can cause anemia. Its stores in our body are severely depleted, resulting in low levels of hemoglobin, thus a lesser amount of oxygen is delivered to cells for energy production.

Signs of an iron deficiency or anemia can include: Apathy, fatigue, headaches, pale skin, poor resistance to cold temperatures, weakness.

There are two types of iron that the body can use from the foods we eat:

A) Heme iron: This group consists of animal-based sources.

The following foods are good sources of heme iron (from animal sources): chicken liver, oysters, clams, beef liver, beef (chuck roast, lean ground beef), turkey leg, tuna, eggs, shrimp, leg of lamb.

B) Non-heme iron: The second type of iron is called non-heme iron and is derived from plant-based iron. The following foods are good sources of nonheme iron (from plants): Raisin bran (enriched), Instant oatmeal, Beans (kidney, lima, navy) Tofu, Lentils, Molasses, Spinach, Whole wheat bread, Peanut butter, Brown rice. Both heme and non-heme sources are essential for healthy iron levels. Heme iron is better absorbed by the body than non-heme iron.

4.ADOLESCENCE

Adolescence is characterised by a large growth spurt and the acquisition of adult phenotypes and biological rhythms. During this period, iron requirements increase dramatically in both boys and girls as a result of the expansion of the total blood volume, the increase in lean body mass, and the onset of menses in young females. The overall iron requirements increase from a preadolescent level of ~0.7–0.9 mg Fe/d to as much as 2.2 mg Fe/d or more in heavily menstruating young women.

These increased requirements are associated with the timing and size of the growth spurt as well as sexual maturation and the onset of menses. The bioavailability from diets in developing and industrialized countries indicates a negative iron balance is likely in many female populations. The low iron stores in these young women of reproductive age will make them susceptible to iron deficiency anemia during pregnancy because dietary intakes alone are insufficient, in most cases, to meet the requirements of pregnancy.

The amount of iron needed each day depends on our age and sex:

- Children aged 1-3 years — 9 milligrams (mg)
- Children 4-8 — 10mg
- Boys 9-13 — 8mg
- Boys 14-18 — 11mg
- Girls 9-13 — 8mg
- Girls 14-18 — 15 mg
- Men aged over 19 — 8mg
- Women aged 19-50 — 18mg
- Women 51+ — 8mg
- Pregnant women — 27mg
- Women breastfeeding exclusively — 9-10mg

Women need more iron to replace the amount lost in blood during menstruation. Until menopause, women need about twice as much iron as men. Iron deficiency occurs when the iron levels are too low, which can lead to Anemia.

5. ANEMIA

Anemia occurs when the number of red blood cells circulating in the body decreases. It is the most common blood disorder. It often develops as a result of other health issues that interfere with the body's production of healthy red blood cells (RBCs) or increase the rates of the breakdown or loss of these cells.

Symptoms

The most common symptom of anemia is fatigue. Other common symptoms include: pale skin, a fast or irregular heartbeat, shortness of breath, chest pain, headaches, light-headedness, people with mild anemia may experience few or no symptoms.

Some forms of anemia with cause-specific symptoms include:

- **Aplastic anemia:** This can cause a fever, frequent infections, and skin rashes.
- **Folic acid deficiency anemia:** This can cause irritability, diarrhea, and a smooth tongue.
- **Hemolytic anemia:** This can cause jaundice, dark urine, a fever, and abdominal pain.
- **Sickle cell anemia:** This can cause painful swelling in the feet and hands, as well as fatigue and jaundice.

The body needs RBCs to survive. They transport hemoglobin, a complex protein that attaches to iron molecules. These molecules carry oxygen from the lungs to the rest of the body.

Various health conditions can result in low levels of RBCs.

a. IRON-DEFICIENCY ANEMIA

Iron deficiency anemia is the most common type of anemia, and blood loss is often the cause. A shortage of iron in the blood leads to this form of the condition, and low iron levels frequently occur as a result of blood loss. Blood loss can be acute and rapid or chronic. Some causes of rapid blood loss include surgery, childbirth, and trauma. Chronic blood loss is more often responsible for anemia. It can result from a stomach ulcer, cancer, or another type of tumor. Other causes of anemia due to blood loss include: gastrointestinal conditions, such as ulcers, hemorrhoids, cancer, or gastritis, use of nonsteroidal anti -inflammatory drugs, such as aspirin and ibuprofen, heavy menstrual bleeding.

II. REVIEW OF LITERATURE

Whole food consumption varies greatly across the globe. This is due to a wide variety of factors that may include the agriculture of the area, access to whole foods, knowledge and education, and economic or social state. According to Ferruzzi and colleagues, as well as Lillioja et al., the average population chooses refined grains over whole grains at a five to one ratio and a large majority are not consuming the recommended amount [1].

Renata Bertazzi Levy, Rafael Moreira Claro, Inês Rugani Ribeiro de Castro (2002-3) was stated that the Group 3 items represented more than one-quarter of total energy (more than one-third for higher-income households). The overall nutrient profile of Group 3 items, compared with that of Group 1 and Group 2 items, revealed more added sugar, more saturated fat, more sodium, less fibre and much higher energy density [3]. The overall study shows that the UPFs represented 40.5 % of mean energy intake. Sugar-sweetened beverages made the largest contribution to energy within the UPF category.

Recent population dietary studies indicate that diets rich in ultra-processed foods, increasingly frequent worldwide, are grossly nutritionally unbalanced, suggesting that the dietary contribution of these foods largely determines the overall nutritional quality of contemporaneous diets. The highest quintile of ultra-processed food consumption had significantly higher BMI (0.97 kg/m2; 95% CI 0.42, 1.51). Over 61.7 % of dietary energy came from ultra-processed products (Group 3), 25.6 % from Group 1 and 12.7 % from Group 2[4].

Ultra-processed food consumption grew from 53.5% of calories at the beginning of the period studied (2001-2002) to 57% at the end (2017-2018). The intake of ready-to-eat or heat meals, like frozen dinners, increased the most, while the intake of some sugary foods and drinks declined. In contrast, the consumption of whole foods decreased from 32.7% to 27.4% of calories, mostly due to people eating less meat and dairy [5]. Consumption of ultra processed foods (NOVA group 4) significantly increased from 61.4% to 67.0%. The percentage of total energy from consumption of unprocessed or minimally processed foods (NOVA group 1) significantly decreased from 28.8% to 23.5%. The estimated percentage of energy from consumption of processed culinary ingredients (NOVA group 2) also significantly increased from 2.4% to 3.4% [6]. In 2017-2018, the subgroups of ultra processed foods that contributed to the largest estimated percentage of energy were industrial grain foods (14.5%), followed by sweet snacks and sweets (12.9%) and ready-to-heat and -eat mixed dishes (11.1%) [7]. Consumption of the most ultra-processed foods had higher average energy intake, greater relative energy contributions from carbohydrates and sugar.

Abay Asfaw stated that the impact of highly processed foods is much stronger. A 10%-point increase in the share of highly processed food items increases the BMI of individuals by 4.25%. It was associated with 1.66 kg/m2 higher BMI (95%CI 0.96–2.36), 3.56 cm greater WC (95%CI 1.79–5.33) and 90% higher odds for being obese (OR = 1.90, 95%CI 1.39–2.61), compared with the lowest consumption [23].Increased UPF intake correlated with an increase in free sugars, total fats, and saturated fats, as well as a decrease in fiber, protein, potassium, zinc, and magnesium, and vitamins A, C, D, E, B12, and niacin. In conclusion, it indicates that increased UPF consumption negatively affects the nutritional quality of diets.

Dietary habits have a large influence on the health of individuals, especially adolescents who need adequate nutrients for their growth. Dietary habits are reflected in the individual's choices of various foods, according to the food group in which they are included. Dietary habits are the main cause of anemia because of the insufficient consumption of iron-containing foods. The results of 19 studies conducted on anaemic individuals showed that there was a significant ($p < 0.01$) increase in hemoglobin levels by 13.2% following regular consumption (21 days to 4.5 years) of millets either as a meal or drink compared with regular diets where there was only 2.7% increase. Seven studies on adolescents showed increases in hemoglobin levels from 10.8 ± 1.4 (moderate anemia) to 12.2 ± 1.5 g/dl (normal). Analysis indicated that among urban women, consumption of <5 servings fruits/day was associated with significantly higher odds of severe and moderate anemia and consumption of <5 servings of vegetables/day was associated with higher odds of moderate anemia [35].

III. RESEARCH METHODOLOGY

It is a comparative study conducted among adolescent girls of age 18-23yrs. A sample of 100 was taken and analyzed their dietary pattern along with their hemoglobin levels.

1. **Selection of Subjects:** Adolescent Female of Age 18-24yrs.
2. **The Food Frequency questionnaire** was conducted using Google forms.

The questionnaire was regarding their Age, Height, and Weight to obtain the BMI of the subject. Also to obtain the Frequency Knowledge about the Consumption of Whole Foods, processed foods, Iron Rich Foods, and the activity of the Individual.

3.Laboratory Analysis (Hemoglobin test): The Procedure is as follows:

3.1. The Collection of Blood samples

The collection of blood samples from the subjects was done by using the DBS Method.
This method was performed using the DBS Kit.
The kit contains Cotton, an Alcohol swab, needle lancet, cellulose paper (specially designed for Blood Clot (spot)), a band-aid, forceps, and a zip lock pouch

Fig-1: DBS Kit
a-alcohol swab, b-needle lancet, c-cellulose paper, d-band-aid, e-forceps, f-zip lock pouch, g-cotton.

3.1.1 Procedure for Collecting blood for Hb Estimation:

- Wipe the left fingertip using an Alcohol swab
- Gently squeeze the fingertip
- Prick the fingertip with the lancet
- Wipe out the first drop of blood and squeeze the fingertip so that one drop of blood wells up
- Spot the blood directly on the cellulose paper labelled as number 1 in pencil
- Cellulose paper containing dried blood spots has been inserted into the plastic zip-lock envelope using forceps and sealed.

Fig-2: Collection of Samples

3.1.2 Hemoglobin Estimation from Dried blood spot using Colour check for Hemoglobin (Hb)

- The cellulose paper containing dried blood spots was taken out from the zip lock envelope for comparing the bloodstain with the colour scale to find the best colour match.
- Keep the test strip (cellulose paper with dried blood spot) close to the back of the colour scale.
- If the blood stain matches one of the shades exactly, record the hemoglobin values.
- If the colour lies between two shades, record the mid-value. If in doubt between the two shades, record the lower value.

Thus, the Hemoglobin (Hb) value of the subjects was obtained.

Note: Avoid direct sunlight during the colour match, marked shade, your shade, or any other shadow.

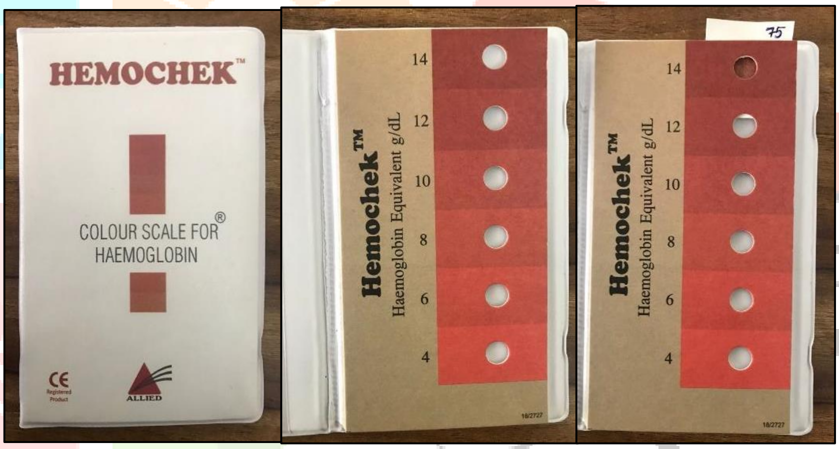

Fig-3: Colour scale for Hemoglobin and colour match using Colour scale of Hemoglobin

3.1.3 Ethical Committee Approval

The Research proposal was presented in front of the Institutional Ethical Committee. The Committee Accepted the Proposal. All the Suggestions were taken care of.

Fig-4: The Research Proposal Presentation to Institutional Ethical Committee

IV. RESULTS & DISCUSSION

Table -1: Physical characteristics of the subjects under study

Physical characteristics	Total Mean ± SD
Age (years)	20.39 ± 1.649
Height (cm)	155.853 ± 8.294
Weight (Kg)	54.123 ± 11.727
BMI (Kg/m2)	22.183 ± 3.9101
Hb (g/dL)	10.19 ± 2.1896

In the above (Table-1), A total of about 100 subjects were recruited under study. The average age of the subjects is 20.39 ± 1.649 with the height 155.853 ± 8.294 and weight 54.123 ± 11.727. The average BMI includes 22.183 ± 3.910. The average value of hemoglobin comes around 10.19 ± 2.1896. The statistical difference based on the hemoglobin and BMI are given below
(Table-2).

Table -2: Difference in the subject characteristics with Hb values

	Normal (>12g/dL) Mean ± SD	Mild (10-11.9g/dL) Mean ± SD	Moderate (7.9-9.9g/dL) Mean ± SD	Severe (<7.9g/dL) Mean ± SD	P-Value One way ANOVA
Age	20.1 ± 1.36	20.1 ± 1.396	20.56 ± 2.018	21.09 ± 1.57	0.309
Height	154.7 ± 7.441	157.8 ± 7.2	155.1 ± 10.3	156.1 ± 5.13	0.513
Weight	52.7 ± 13.41	55.8 ± 10.5	54.7 ± 12.14	51.81 ± 8.55	0.694
BMI	21.8 ± 4.23	22.3 ± 3.85	22.67 ± 3.96	21.37 ± 3.17	0.688
Hb	12.85 ± 1.247	10.4 ± 1.01	8.81 ± 0.526	6.8 ± 0.408	0.000

In the above (Table-2) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through mean ± SD and compared to Hb levels. It was found that there is no statistical significance in weight (p=0.694) and other parameters like age (p=.0309), Height(p=0.513) and BMI(p=0.688) within and between the groups. However, there is a significant difference in the hemoglobin (P=0.000) levels within and between the groups.

Table -3: Difference in the subject characteristics in different BMI

	Normal (18.5-22.9kg/m^2) Mean ± SD	Underweight (<18.5 kg/m^2) Mean ± SD	Overweight (23.0-27.5 kg/m^2) Mean ± SD	Obese (>27.5 kg/m^2) Mean ± SD	P-value
Age	20.8 ± 1.84	19.25 ± 0.866	20.00 ±.961	20.24 ± 1.513	0.017
Height	156.02 ± 6.35	155.10 ± 11.17	154.42 ± 9.737	156.80 ± 10.205	0.850
Weight	50.026 ± 6.19	41.083 ± 6.082	57.071 ± 6.821	70.143 ± 10.603	0.000
BMI	20.47 ± 1.37	17.038 ± 1.17	23.861 ± 0.6652	28.395 ± 2.0431	0.000
Hb values	10.21 ± 2.48	10.29 ± 2.13	10.13 ± 1.57	10.104 ± 1.904	0.995

In the above (Table-3) when the subjects are studied based on the BMI, it was observed that, there is a statistical significance in the physical characteristics like Age (P=0.017), Weight(P=0.000) and BMI (0.000). However, there was no significance difference in height (P=0.850) and Hb levels (0.995) within and between the groups. All the groups were found to have lower hemoglobin levels (<11.9g/dL).

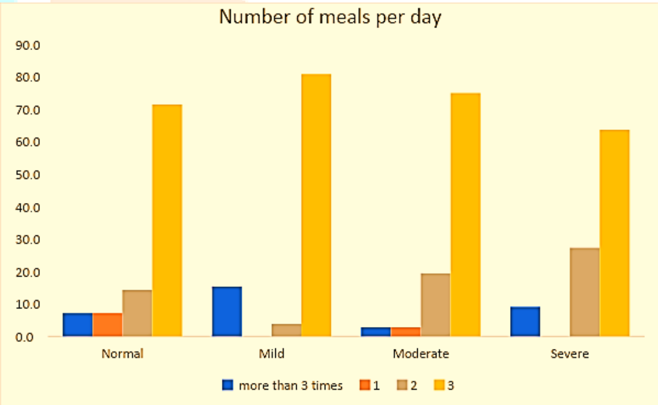

Fig-5: Number of meals per day

The above graph (Fig-5) represents the number of meals per day of selected subjects under study. It was observed that the highest number of subjects are consuming more than 3 meals per day (81%) and least were observed consuming one meal/day (9%).

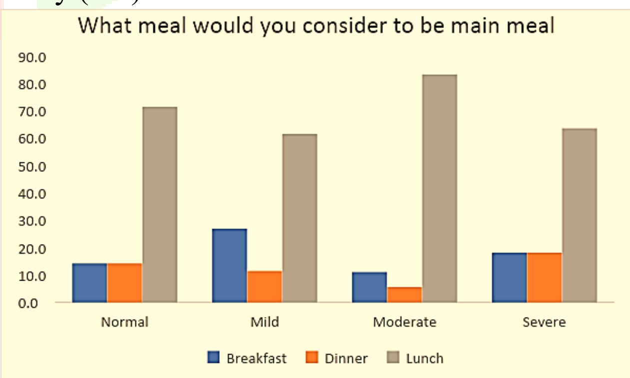

Fig-6: Meal to be considered as their main meal of the day

The above graph (Fig-6) represents the meal to be considered as their main meal of the day. It was observed the highest number of subjects are considering their main meal as Lunch (82%) and the least were observed considering dinner (17%) as their main meal of the day.

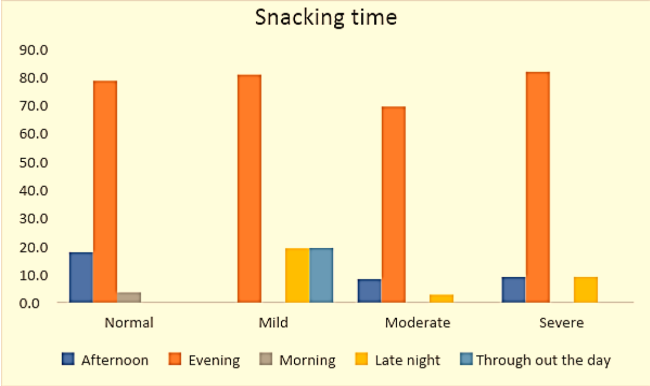

Fig-7: Snacking Time

The above graph (Fig-7) represents the snacking time. It was observed that the snacking time is highest during the evening (85%) in all the group's understudies and least was observed during their snacking time during morning (5%).

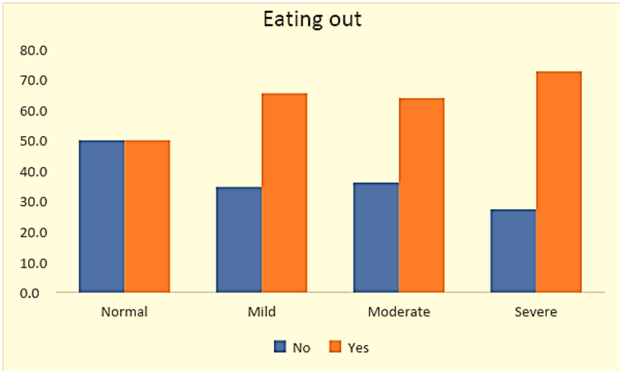

Fig-8: Eating Out

The above graph (Fig-8) represents the Eating out. It was observed that the highest (75%) subjects under severe are eating out and the least (15%) are not eating out. Also, the subjects under normal represents the equilibrium of eating out (50%) &not eating out (50%).

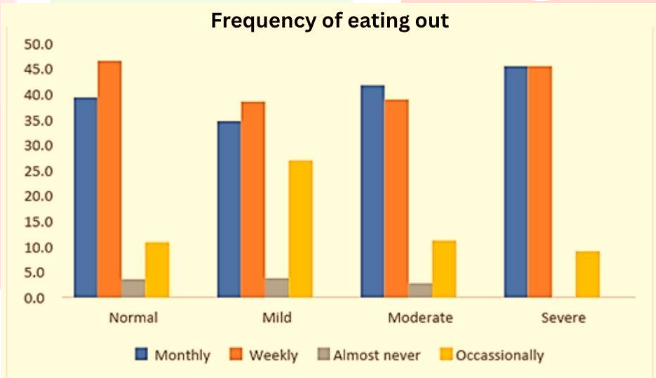

Fig-9: The Frequency of Eating out

The above graph (Fig-9) represents the frequency of eating out, it was observed that the frequency of eating out was higher during weekly (47%) than the monthly (28%) followed by never (3%) and occasionally (12%) of all subjects under study.

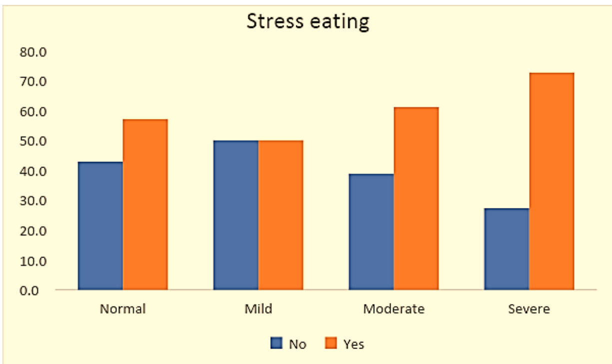

Fig-10: Stress Eating

The above graph (Fig-10) represents the stress eating. It was observed that the severe (75%) consumption of stress eating among the subjects under study and the least (15%) were observed as not stress-eating.

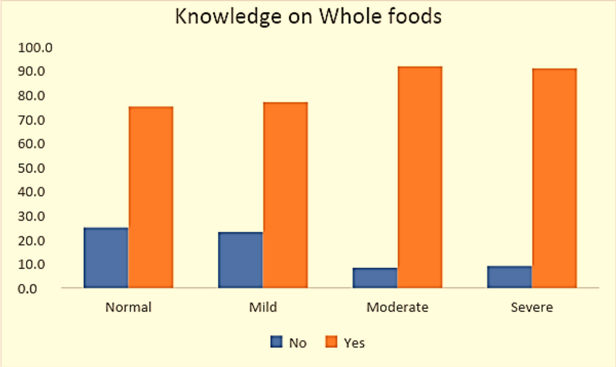

Fig-11: Knowledge of Whole Foods

The above graph (Fig-11) represents the knowledge of whole foods. It was observed that the highest (95%) number of subjects with respect to the knowledge of whole foods among the groups and the least (5%) were observed as they are unaware of whole foods.

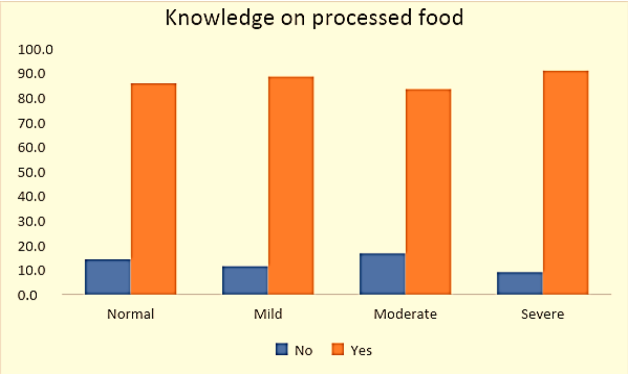

Fig-12: Knowledge of Processed Foods

The above graph (Fig-12) represents the knowledge of Processed foods. It was observed that the highest (92%) number of subjects with respect to the knowledge of Processed foods among the groups and the least (8%) were observed as they are unaware of processed food.

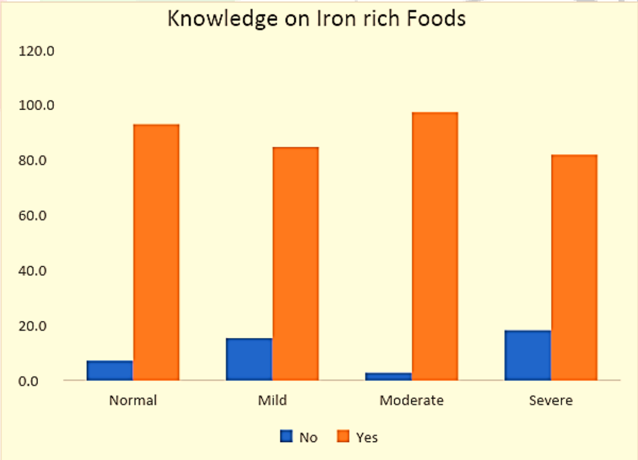

Fig-13: Knowledge of Iron-Rich Foods

The above graph (Fig-13) represents the knowledge of Iron-rich foods, it was observed that the highest (97%) number of subjects with respect to the knowledge of Processed foods among the groups and the least (3%) were observed as they are unaware of Iron-rich foods0

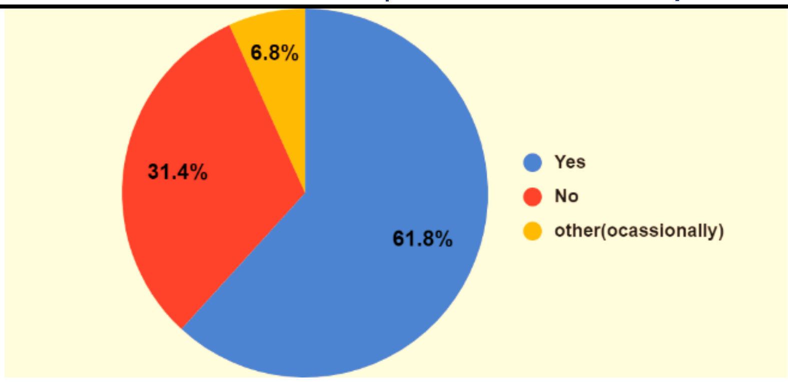

Fig-14: Frequency of Activity

The above pie chart (Fig-14) represents the frequency of activity. It was observed that the higher frequency of activity (61.8%) and no activity (31.8%) followed by activity occasionally (6.8%) among all subjects under study.

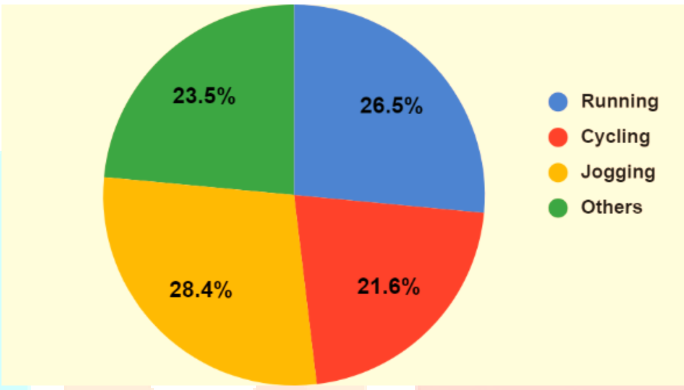

Fig-15: Preferred Activity

The above pie chart (Fig-15) represents the Preferred activity of the subjects, it was observed that the higher frequency of jogging (28.4%) and running (26.5%) followed by cycling (21.6%), Other activities (23.5%) among all subjects under study.

<u>FREQUENCY OF CONSUMPTION OF FOODS</u>

Table 4.1-CEREALS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Rice	100	11.5	2.8	9.1
Brown Rice	100	3.8	8.3	9.1
Oats	100	15.4	11.1	18.2
Brown Bread	10.7	15.4	16.7	27.3

In the above (Table 4.1) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of cereals is higher in normal (100%) subjects than the other subjects under other criteria.

Table 4.2-MILLETS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Ragi	3.6	23.1	16.7	9.1
Bajra	10.7	11.5	16.7	9.1
Jowar	10.7	15.4	13.9	18.2
Foxtail	14.3	7.7	13.9	9.1

In the above (Table 4.2) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of millets is higher in subjects under moderate (16.7%) than the other normal subjects followed by mild and moderate

Table 4.3-PULSES

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Red gram	10.7	26.9	8.3	9.1
Green gram	17.9	19.2	19.4	18.2
Chickpea	21.4	19.2	8.3	18.2

In the above (Table 4.3) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of pulses is higher in subjects under mild (26.9%) than the other normal subjects followed by mild and moderate.

Table 4.4-MILK & MILK PRODUCTS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Milk	14.3	23.1	16.7	18.2
Skimmed Milk	10.7	15.4	13.9	9.1
Ghee	17.9	11.5	8.3	18.2
Curd	14.3	15.4	13.9	9.1
Paneer	3.6	15.4	19.4	9.1
Tofu	10.7	15.4	16.7	18.2
Cheese(processed)	17.9	23.1	2.8	9.1

In the above (Table 4.4) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of millets is higher in subjects under mild (16.7%) than the other normal subjects followed by severe and moderate

Table 4.5-ANIMAL SOURCES

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Meat	21.4	26.9	22.2	54.5
Liver & organs of meat	17.9	3.8	2.8	9.1
Poultry	28.6	23.1	2.8	36.4
Fish	17.9	15.4	2.8	18.2

In the above (Table 4.5) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of animal foods is higher in subjects under normal (17.9%) than in the other severe subjects followed by mild and moderate.

Table 4.6-VEGETABLES

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Vegetables	10.7	15.4	8.3	9.1

In the above (Table 4.6) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of millets is higher in subjects under mild (15.4%) than the other normal subjects followed by severe and moderate.

Table 4.7-NUTS AND SEEDS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Almonds	3.6	19.2	22.2	9.1
Cashew	14.3	19.2	16.7	18.2
Walnuts	14.3	19.2	13.9	9.1
Dates	14.3	11.5	25	18.2
Pumpkin seeds	14.3	11.5	11.1	9.1
Flax seeds	3.6	15.4	8.3	45.5
Chia seeds	14.3	15.4	8.3	9.1

In the above (Table 4.7) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of nuts & seeds is higher in subjects under moderate (19.2%) than tin he other normal subjects followed mild and moderate.

Table 4.8-SUGAR & SUGAR PRODUCTS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Candy	10.7	7.7	16.7	18.2
Sweets	10.7	15.4	13.9	9.1
Cakes	17.9	19.2	11.1	9.1
Chocolate (flavoured)	3.6	15.4	22.2	9.1
Dark Chocolate	17.9	19.2	19.4	18.2
Jellies	14.3	11.5	2.8	9.1
Jams	14.3	19.2	8.3	9.1

In the above (Table 4.8) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of sugar & sugar products is higher in subjects under moderate (19.2%) than in the other normal subjects followed mild and moderate.

Table 4.9- SUN DRIED PRODUCTS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Dried Tomatoes	14.3	7.7	5.6	9.1
Dried chilies	21.4	19.2	11.1	9.1
Papads	17.9	19.2	16.7	18.2

In the above (Table 4.9) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of Sundried Products is higher in subjects under moderate (19.2%) than in the other normal subjects followed mild and moderate.

Table 4.10-READY MADE MIXES & INSTANT PRODUCTS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Idly & dosa ready mix	17.9	15.4	11.1	18.2
Cake ready mix	14.3	15.4	5.6	9.1
Sauces	14.3	15.4	11.1	18.2
Breakfast cereals	10.7	15.4	8.3	9.1
White bread	21.4	15.4	13.9	27.3

In the above (Table 4.10) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of Ready-made mixes & instant products was higher in subjects under severe (27.3%) than the other normal subjects followed mild and moderate,

Table 4.11-SNACKS (FAST FOOD)

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Potato Chips	21.4	26.9	16.7	18.2
Noodles	14.3	19.2	16.7	9.1
Pizza	21.4	23.1	16.7	9.1
Burgers	17.9	11.5	11.1	18.2
French fries	17.9	19.2	2.8	9.1
Cookies	21.4	11.5	2.8	9.1
Ready to drink shakes	17.9	19.2	2.8	18.2
Carbonated drinks	14.3	26.9	8.3	18.2

In the above (Table 4.11) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of snacks is higher in subjects under moderate (23.1%) than in the other normal subjects followed by mild and moderate

Table 4.12-CANNED FOODS

	Normal (>12g/dL)	Mild (10-11.9g/dL)	Moderate (7.9-9.9g/dL)	Severe (<7.9g/dL)
Canned Vegetables	10.7	11.5	16.7	18.2
Canned Meats	7.1	7.7	2.8	18.2
Canned Fruits	7.1	7.7	2.8	18.2

In the above (Table 4.12) the data was analysed using the software IBM-SPSS 24.0 at the significance level of 5%. Quantitative variables with normal distribution were described through valid percentages and compared to Hb levels. It was found that the frequency of consumption of canned foods is higher in subjects under severe (18.2%) than the other normal subjects followed mild and moderate

V. CONCLUSION

In the present study, it was found that there was a relation between subjects consuming food that had an impact on their hemoglobin levels i.e., below <12(anemic). This is because of dietary changes, lifestyle changes such as eating out frequently, stress eating and higher consumption of processed foods than the whole foods.

The technique of Hb estimation to detect anemia has been developed by the DBS method which can colour match using a chart. Therefore, such technology can be easily integrated into all the rural and urban areas for obtaining the prevalence of anemia. The supply of such kit is cheap, and affordable to all the lower section of the population, especially in India. Since this is a pilot study, it could be encouraging to do further studies on a large population belonging to various citizens in India. As food culture varies from city to city, region to region and also country to country. Therefore, such programs on food consumption can be taken up by the government, NGOs and International agencies like UNICEF, WHO etc.

VI. ACKNOWLEDGEMENT

I am thankful to the almighty for his grace, which made me work and complete this project work. I am grateful to the sister principle of St Anns college for women, for providing me an opportunity of doing this work.

I express a deep sense of gratitude to Dr. Meena Patangay, dean of administration and head of nutrition department, St Ann's college for women for providing me an opportunity of doing this project work and for her continuous guidance, constant support and valuable suggestions all through this project work.

This acknowledgement will be in complete if I fail to express my deep sense of gratitude to indebtedness to Mrs. Hannah Jessie Francis. T, faculty of nutrition department.

I would like to thank all the faculty of the department of St Anns, of dietetics and clinical nutrition for their immense support during the entire two years of this master course. I am very grateful to my beloved parents and friends for their constant support and encouragement given to me. Lastly, I thank all the participants of the study for their cooperation and participation.

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