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Ascertainment of Contents in Soft Drinks and their Impact on Health

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Abstract: ***The purpose of the project was to determine the content of soft drinks and their impacts on health. Soft drinks are very popular and highly noticeable around the world and all soft drinks contains different contents such as sugar, alcohol, phosphoric acid, malic acid, acetic acid, alkaloids, heavy metals like lead, and carbon dioxide. Consumption of soft drinks in large quantities has raised serious questions about their effects on health and play a major role in a variety of diseases like diabetes, dental and bone disorders and others which are more among in youth. So the examination is required by the way that the excessive use of soft drinks in daily life means large number of diseases due to their, only detrimental ingredients. In this paper we checked the effect of soft drinks consumption in high quantity on health of the people, since mostly people drinks soft drinks for refreshment, taste, color etc.***

The methodology adopted for this study is quantitatively, the project used experimental methods in comparative and qualitative study and determine different contents of soft drinks based on their presences and absences. The contents such as sugar (glucose and sucrose), alcohol,alkaloids,carbon dioxide and their pH values have been analyzed through the use of different reagents and apparatus. Also the project used questionnaires and interview methods to evaluate the knowledge, practice and awareness of taking soft drinks in the society and examined the association between soft drinks content and human health. It consulting people of almost all age groups in our area, who consuming soft drinks with a structured questionnaire. The data has been collected by using convenient sampling technique, analyzed and interpreted by the help of the graphical representation technique and statistical package for social science, the association between soft drinks and human health was checked by using Chi-square test. The project provided a comprehensive study of the impact of soft drinks on health as well as to suggest alternatives for a healthy life style.

Keywords: Health impact, soft drinks, obesity, kidney and liver problem, heart disease, teeth corrosion.

I. INTRODUCTION

Soft drinks are water based flavored drinks usually added with carbon dioxide, nutritive, non-nutritive and intense sweeteners with other permitted food additives. Soft drink market is expanding day to day due to continue focus of user's demands and functionality.

The era of soft drinks began in 1952, in the development of fruit flavored drinks in the medieval Middle East. In Tanzania the era of soft drinks began only in 1960s and marked the launched of multinational companies brands such as Coca-Cola companies, sayona drinks ltd, Azam and MO brands. These brands produce different soft drinks such as Coca-Cola, energy drinks, novida, 7up and more others. Soft drinks are classified into carbonated and non-carbonated drinks on the basis of their composition. Carbonated soft drinks are some of the most consumed beverage types; these soft drinks are nonalcoholic beverages that typically contain water, sugar, and flavored agents. For marketing, soft drinks are the fast moving goods. Soft drinks are consumed for various reasons and in various occasions by consumers based on various aspects like price, convenience and social status.

Peoples consume soft drink to give them refreshing feelings and others consume soft drinks for believe that soft drinks like energy drink activate brain. Although soft drinks are very popular around the world, their consumption in large quantities has raised serious questions about their impacts on human health due to presence of contents like heavy metals such as lead and cadmium, sugar, alkaloids like narcotics alkaloid and caffeine. Through project we wanted to confirm whether the charge imposed to those brands of soft drinks are true or not.

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Soft drinks have become a necessary part of our daily lives, no meal is considered complete without these soft drinks. However there are rumors or complains concerning the amount of contents of soft drinks that they do contain harmful materials such as sugar, phosphoric acids, heavy metals, alkaloids, and alcohol. Thereby our project aim to find whether these rumors are true or not and providing solutions to the society on the proper consumption of soft drinks and identifying both nutritive and harmful contents found in soft drinks of different brands such as coca cola, novida, 7up, and energy drinks (azam and MO energies).

It helps us to come up with new knowledge of comparative and qualitative analysis. This can be through performing different experiments on determining and analyzing contents that may be presents in different soft drinks.

Helps to know the harmful materials that may be present in different soft drinks which may either leads to weight gain, bone damage, kidney failure, heart disorders, liver and brain damage; this can helps consumers to avoid the use of soft drinks with higher contents of these harmful materials.

Helps to know useful/ nutritional materials that may be present in different soft drink; Knowing nutritional materials that may be present in soft drinks can make easy advising on the use and requirement of a certain drink.

Also findings of this study can helps to open the new gap ways for future research on the link between contents in soft drinks and their impacts on human health as well as to bring about human health friendly ingredients of soft drinks through modification of soft drinks products

According to Karishma, .Surekha & Shahinaz B (2018) on their project titled "Soft drinks content and their health impact". They identified different harmful Contents found in soft drinks, such as sugar, caffeine,phosphate, caramel color, bis-phenol, and trace of alcohol.Sugar, Soft drinks are loaded with high amounts of sugar, which can lead to weight gain, obesity, and an increased risk of developing type 2 diabetes. Excessive sugar intake also puts a strain on the liver and can contribute to chronic diseases such as heart dis well-being.Caffeine, carbonated drink is more readily absorbed than any other drink (like coffee, chocolate etc.). Caffeine disturbs sleep by stimulating nervous system.

Different disease arose due to higher consumption of soft drinks,this are kidney stones, cardiovascular disease, obesity, weight gain etc. According to Malick A. (2019) the author discuss the potential negative effects of consuming soft drinks on various aspects of human health, including obesity, diabetes, cardiovascular disease, dental health, and bone health. They also explore the underlying mechanisms by which soft drinks may contribute to these health problems, such as their high sugar content, artificial sweeteners, and additives. According to Forshee R. (2004),This study systematically the study focused on the association between soft drink consumption and obesity. The authors found a positive relationship between the two, with a consistent pattern across different study designs and populations. They highlight the potential role of excess energy intake from soft drinks, low satiety, and displacement of more nutritious beverages in contributing to obesity.

There is a link between soft drink consumption and various health outcomes, according to Lenny.R, Schwartz .M & Brownell.K(2006)on their journal titled “effects of soft drink consumption on nutrition and health” they examined different health outcomes based on consumption of soft drinks, such as the relationship between soft drinks and body weight were the research evaluated that consumption of soft drinks in high amount people’s risk of being overweight or obese.

Soft Drink Consumption and Risk of Developing Metabolic Syndrome and Cardiovascular Disease: according to Ravi D, Sullivan. L & Vasan. S, (2007), This meta-analysis examined the association between soft drink consumption and the risk of metabolic syndrome and cardiovascular disease. The authors found a significant positive relationship between soft drink consumption and these health outcomes , in middle aged adults, soft drink consumption is associated with a higher prevalence and incidence of multiple metabolic risk factors and cardiovascular diseases. They emphasize the adverse effects of added sugars, artificial sweeteners, and accompanying unhealthy lifestyle behaviors related to soft drink consumption.

II. RESEARCH METHODOLOGY AND METHODS

A. Methodology

Soft drinks of different brands are composed of different contents/ingredients such as alcohol, sugar, heavy metals, phosphoric acidic, citric acid, malic acid, caffeine, carbon dioxide etc. The study used experimental method, Questionnaire method, and Interview method to analyses the presence of these contents in soft drinks.

1) *Questionnaire Method:* The project looks on contents of soft drinks and their health impact, from this we conducted open and closed questionnaire at mbezi stand luguruni and kwembe areas .The questionnaires finds awareness of soft drinks users on the effect high consumption of soft drinks and the rate of soft drinks consumption.
2) *Interview Method:* The study, used interview method for asking open ended questions to converse with respondents for collect elicit data. Also the study used interview method for the respondents who are unable to read a set of prepared questionnaires.

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3) *Experimental Method:* Involves testing and qualitative analysis of contents that found in different soft drinks through the use of different soft drink samples, different reagents and apparatus. This method was done in the laboratory through a series of different experiments and titrations.

B. Apparatus used

1) P^H Meter and P^H paper
2) Test tube
3) Test tube holder
4) Measuring cylinder
5) Stop watch
6) Beaker
7) Water bath
8) Tripod stand
9) Burette
10) Dropper
11) Gas jar
12) Evaporating dishes

C. Chemicals and reagent used

Iodine solution

1) Potassium iodine
2) Sodium hydroxide
3) Mayer's reagent
4) Lime water
5) Benedict solution
6) Fehling's solution
7) Hydrogen sulphide gas
8) Hydrochloric acid
9) Potassium chlorate
10) Ammonium hydroxide

III. EXPERIMENTATION METHODS

A. Experiment no: 01

Detection of P^H

General Procedures:

- Samples of each soft drink from different brands were taken into a 100ml beaker, the placed in a P^H Meter and dipped an electrode to find the value of PH of these soft drinks.
- 1-2 drops of the sample of each soft drink of each brand was taken and put on the PH paper. Then the color changes were noticed and were compared with the standard PH scale.

Observation

Table .1: PH detection

			OBSERVATION		
S. NO	NAME OF THE SOFT DRINK	PROCEDURES	PH PAPER COLOR CHANGE	PH METER READING VALUE	INFERENCES
1	Coca cola	• 5ml of coca cola where placed into a test tube and then PH meter were immersed in it and recording the PH value	Pinkish Color	2.3	Acidic in nature

		• 2 drops of coca cola sample were taken and put on the blue litmus paper, color change were observed.			
2	Azam energy drink	• 5ml of Azam energy where placed into a test tube and then PH meter were immersed in it and recording the PH value • 2 drops of Azam energy sample were taken and put on the blue litmus paper, color change were observed	Reddish Color	4.4	Acidic in nature
3	MO energy drink	• 5ml of MO energy where placed into a test tube and then PH meter were immersed in it and recording the PH value • 2 drops of MO energy sample were taken and put on the blue litmus paper, color change were observed	Reddish Color	4.1	Acidic in nature
4	Novida	• 5ml of Novida where placed into a test tube and then PH meter were immersed in it and recording the PH value • 2 drops of Novida sample were taken and put on the blue litmus paper, color change were observed	Pinkish color	3.9	Acidic in nature

- *Conclusion:* Soft drinks are generally acids, since their PH value arrange from 2.8 to 4.1 because of the presences of citric acid, malic acid and phosphoric acid. Also the PH values of these soft drinks are different due to the variation in the amount of acidic contents.

B. Experiment no: 02

Test for carbon dioxide

General procedures;

As soon as the bottles were opened, one by one the samples were passed through lime water and then the stop watch was started and record the time where the lime water will turn milky color by each sample of soft drink.

Table 2: Test for carbon dioxide

S.NO	Name soft drink	Time taken(sec)	Observation	Inferences	Positive observation of milky color solution
1	Coca cola	30	Milky color solution	CO_2 was present	
2	Azam energy	23	Milky color solution	CO_2 was present	
3	MO energy	25	Milky color solution	CO_2 was present	
4	Novida	32	Milky color solution	CO_2 was present	
5	7UP	34	Milky color solution	CO_2 was present	

- Conclusion, all tested samples of soft drinks contains dissolved carbon dioxide in water. The carbon dioxide dissolves in water to form carbonic acid, which responsible for its tangy taste.

Chemical reaction involved

Lime water turns milky when reacts with carbon dioxide to form calcium carbonate which is insoluble in water and thus forms a milky white precipitate.

$\longrightarrow Ca(OH)_2(s) + CO_2(g)$ $CaCO_3(S) + CO_2(g)$

C. Experiment no: 03

Test for Glucose

Glucose is a reducing; its presence can be detected by the following

1) Benedict's Solution Test

Procedures

5ml of a sample of soft drink of different brands was taken in a test tube

2 drops of Benedict's solution were added and the mixture in test tube was heated for five minutes.

Formation of series of color changes from blue-yellow-orange to reddish coloration solution indicates the presence of glucose in soft drink.

Table 3: Benedict's solution test

S.NO	Name of the soft drink	Observation	Inferences	Series of color changes in tested samples
1	Coca cola	Series colors were observed from blue-yellow-orange to reddish	Glucose was present	
2	Azam energy	Series colors were observed from blue-yellow to orange	Glucose was present	
3	MO energy	Series colors were observed from blue-yellow to orange	Glucose was present	
4	Novida	Series colors were observed from blue-yellow – orange to reddish coloration	Glucose was present	
5	7UP	Series colors were observed blue-yellow – orange -reddish	Glucose was present	

- Conclusion: All samples give positive test for glucose with Benedict's reagent. Hence all soft drinks contain glucose. Soft drinks which its test end up on forming orange coloration as end point color indicates the presence of lower glucose amount.

2) Fehling's Solution Test

Procedures

Small samples of soft drinks of different brands were taken in a test tube and a few drops of Fehling's solution.

The test tube was heated in water bath for 10 minutes. Appearance of brown precipitate confirmed the presence of glucose in soft drinks.

Table .4: Fehling's solution test

S.NO	Name of the soft drink	Observation	Inferences	Reddish brown precipitate in a sample of Novida
1	Coca-Cola	Reddish Brown Precipitate	Glucose was present	
2	Azam energy	Reddish Brown Precipitate	Glucose was present	
3	MO energy	Reddish Brown Precipitate	Glucose was present	
4	Novida	Reddish Brown Precipitate	Glucose was present	
5	7UP	Reddish Brown Precipitate	Glucose was present	

- Conclusion, All samples gave positive test for glucose with Fehling's solution. Hence all the soft drinks contain glucose.

D. Experiment no, 04

1) Test for Alcohol

Procedures:

Small samples of each brand of soft drinks were taken in separate test tubes and Iodine were added followed by Potassium Iodide and Sodium Hydroxide (NaOH) solution was added to each test tube.

Then the test tubes were heated in hot water bath for 40 minutes. Appearance of yellow colored precipitate confirmed the presence of alcohol in some soft drinks.

Table 4: Test for alcohol

S.NO	Name of the soft drink	Observation	Inferences	Positive test
1	Coca-Cola	Yellow Precipitate	Alcohol was present	
2	Azam energy	Yellow Precipitate	Alcohol was present	
3	MO energy	Yellow Precipitate	Alcohol was present	
4	Novida	Clear solution were observed	Alcohol was absent	
5	7UP;	Yellow Precipitate	Alcohol was present	

- *Conclusion:* Four soft drinks samples (coca cola, azam energy, Mo energy, and 7UP) gave positive test for alcohol. Novida shows negative test of alcohol. Chemical Reaction $CH_3CH_2OH + 4I_2 + 6NaOH \rightarrow CHI_3 + HCOONa + 5NaI + 5H_2O$

E. Experiment no, 05: Test for Sucrose

5 ml samples of each brand of soft drinks were taken in separate test tubes and were heated very strongly until changes occur. Black colored residue were left confirmed the presence of sucrose in soft drinks.

Table 5: Test for sucrose

S.NO	Name of the soft drink	Observation	Inferences	Positive observation
1	Coca-Cola	Black residue observed	Sucrose was present	
2	Azam energy	Black residue observed	Sucrose was present	
3	MO energy	Black residue observed	Sucrose was present	
4	Novida	Black residue observed	Sucrose was present	
5	7UP	Black residue observed	Sucrose was present	

- *Conclusion:* All the brands of soft drinks contain sucrose. But amount of sucrose varies in each brand of drink. Novida contains highest amount of sucrose.

F. Experiment no, 06

1) Test for Alkaloids

Different types of alkaloids have their specific tests dependent on the nature and derivative of the alkaloids. During the experiment we tested only two kinds of alkaloids; these include purine derivative (caffeine) and narcotics alkaloids.

a) Murexide Test

Procedures:

2ml of each sample of soft drink from different brands was taken into a test tube and heated to dry for 15 minutes.

Small amount of solid potassium chlorate was added followed by 1 drop of dilute hydrochloric acid.

The mixture was heated again for about 10 minutes till its dryness, then a drop of ammonium hydroxide.

Formation of purple/ pink color indicates the presence of caffeine.

Table 6.0: Murexide test of alkaloids

S.NO	Name of the soft drink	Observation	Inferences	Positive test
1	Coca-Cola	Purple color was observed	Caffeine was present	
2	Azam energy	Purple color was observed	Caffeine was present	
3	MO energy	Purple color was observed	Caffeine was present	
4	Novida	No pink/purple color was formed	Non caffeinated soft drink	
5	7UP	No pink/purple color was formed	Non caffeinated soft drink	

- *Conclusion;* Some of soft drinks from different brands are caffeinated such include MO energy, Azam energy and coca cola, they give positive results with murexide test, while others like Novida and 7UP are non- caffeinated soft drinks they give negative results with murexide test.

b) Mayer's Test

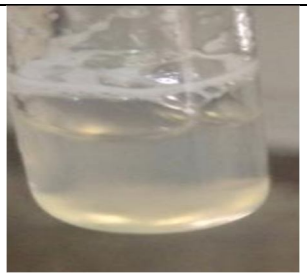
Procedures

2ml of a sample from each soft drink of different brands was taken into a test tube.

2 drops of Mayer's reagent was added and the mixture was shaken for 3minutes and left to settle.

A yellowish- white (cream) precipitate was formed indicates the presences of alkaloids.

Table. 6.1: Mayer's test of narcotics alkaloids

S.NO	soft drink	Observation	Inferences	Positive test
1	Coca-Cola	Yellowish precipitate formed	Narcotics alkaloids was present	
2	Azam energy	Color of a drink retained	Narcotics alkaloids was absent	
3	MO energy	Color of a drink retained	Narcotics alkaloids absent	
4	Novida	Yellowish- white cream precipitate formed	Narcotics alkaloids was present	
5	7UP	Colorless solution was formed	No alkaloids present	

- *Conclusion:* Some of soft drinks contain narcotics alkaloids, those soft drinks were including, coca cola and Novida while 7up and energy drinks shows negative Mayer's test, means that no narcotics alkaloids was found.

G. Experiment no, 07

Test for Heavy metals.

Test for lead

Procedures:

- 2ml of sample soft drinks from each brand was taken into separate test tube.
- 2cm^3 of KI were added into each test tube.
- The mixtures were placed into a water bath for 15minutes and observation was made.

Table 7. Lead test

S.NO	Name of the soft drink	Observation	Inferences	Positive test
1	Coca-Cola	Yellow precipitate	Lead was present	
2	Azam energy	Yellow precipitate	Lead was present	
3	MO energy	Yellow precipitate	Lead was present	
4	Novida	Colorless solution was observed	Lead was absent	
5	7UP	Yellow precipitate	Lead was present	

- *Conclusion:* Four soft drinks out of the tested sample contain lead, they shows positive test with KI while novida shows negative test with KI hence lead was absent in novida.

H. Experiment no, 08

Test for Cadmium

Procedures:

2ml of a sample soft drink of different brands were taken into a test tube separately.

1ml of KCN solution were added drops by drops until the color disappears.

H_2S gas were passed through the solution for 1minute.Yellow precipitates observed

Table 3.8: Cadmium test

S.NO	Name of the soft drink	Observation	Inferences	Positive test
1	Coca-Cola	Yellow precipitate	cadmium was present	
2	Azam energy	Yellow precipitate	cadmium was present	
3	MO energy	Yellow precipitate	cadmium was present	
4	Novida	Colorless solution was observed	cadmium was absent	
5	7UP	Yellow precipitate	cadmium was *present*	

- *Conclusion;* Four soft drinks from tested sample were tested to have cadmium while novida gives negatives test of cadmium**.**

I. Experiment no 09.0: Quantification of acids Concentration

Figure 3.3: Quantification of acids concentration 1

Procedures

1ml of 0.1M sodium hydroxide was added into a 25ml capacity burette,10ml of a sample soft drink were put into a conical flask, and 2 drops of p.o.p were added.

A small sample was titrate against the burette solution until the end point was reached were there was the appearance of pink color

Table 8: Quantification of acid concentration in coca cola (phosphoric acid)

PILOT	1	2	3
FINAL VOLUME(cm^3)	2.40	2.50	2.50
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	2.40	2.50	2.50

AVERAGE VOLUME USED= 2.50cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (phosphoric acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M

VA; volume of acid (phosphoric acid) = 10ml

VB; volume of base (sodium hydroxide) = 2.50cm^3

$3NaOH_{(aq)} + H_3PO_{4\,(aq)} \longrightarrow Na_3PO_{4\,(aq)} + 3H_2O_{(l)}$

Therefore; nB: number of mole of base (NaOH) = 3 and nA: number of mole of acid (H_3PO_4) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times2.5\times1}{10\times3} = \frac{0.25}{30}$ = 0.008M,

Amount in g/l = molarity $\times$ molar mass =98 $\frac{g}{mol}$ $\times$ 0.008 $\frac{mol}{l}$ =0.784 $\frac{g}{l}$

- *Conclusion:* The concentration of phosphoric acid present in 600ml coca cola was **0.008**M.

It implies that coca cola is more acidic in nature with strong acid (phosphoric acid) of PH range from 2.1-2.7 and contains 0.784gram of phosphoric acid in each liter of coca cola.

Table 8: Quantification of acid concentration in coca cola (citric acid):

PILOT	1	2	3
FINAL VOLUME(cm^3)	2.40	2.50	2.50
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	2.40	2.50	2.50

AVERAGE VOLUME USED= 2.50cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (citric acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M

VA; volume of acid (citric acid) = 10ml

VB; volume of base (sodium hydroxide) = 3.00cm^3

$C_6H_8O_7 + 3NaOH \longrightarrow C_6H_5O_7Na_3 + 3H_2O$

Therefore; nB: number of mole of base (NaOH) = 3 and nA: number of mole of acid (Citric acid) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times2.5\times1}{10\times3} = 0.008M$

Amount in g/l = molarity $\times$ molar mass =192 $\frac{g}{mol} \times 0.008 \frac{mol}{l} = 1.54 \frac{g}{l}$

- *Conclusion;* The concentration of citric acid present in 600ml coca cola was **0.008**M. And contains 1.54 gram of citric acid in each liter of coca cola.

Table 9: Quantification of acid concentration in

PILOT	1	2	3
FINAL VOLUME(cm^3)	3.80	3.70	4.00
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	3.80	3.70	4.00

AVERAGE VOLUME USED=3.8cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (malic acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M

VA; volume of acid (malic acid) = 10ml

VB; volume of base (sodium hydroxide) = 3.8cm^3

$C_4H_6O_{5(aq)} + 2NaOH \longrightarrow C_4H_4O_5Na_{2(aq)} + 3\ H_2O_{(l)}$

Therefore; nB: number of mole of base (NaOH) = 2 and nA: number of mole of acid (malic acid) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times3.8\times1}{10\times2} = 0.02M$

Amount in g/l = molarity $\times$ molar mass =134 $\frac{g}{mol} \times 0.02 \frac{mol}{l} = 2.68 \frac{g}{l}$

- *Conclusion:* The concentration of malic acid present in 600ml novida was 0.02M. And contains 2.68 gram of malic acid in each liter novida

Table 10: Uantification of acid concentration in

PILOT	1	2	3
FINAL VOLUME(cm^3)	3.80	3.70	4.00
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	3.80	3.70	4.00

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AVERAGE VOLUME USED=3.8cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (citric acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M

VA; volume of acid (citric acid) = 10ml

VB; volume of base (sodium hydroxide) = 3.00cm^3

$C_6H_8O_7 + 3NaOH \longrightarrow C_6H_5O_7Na_3 + 3H_2O$

Therefore; nB: number of mole of base (NaOH) = 3 and nA: number of mole of acid (Citric Acid) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times3.8\times1}{10\times3} = 0.013M$

Amount in g/l = molarity $\times$ molar mass =192 $\frac{g}{mol} \times 0.013 \frac{mol}{l} = 2.5 \frac{g}{l}$

- *Conclusion:* The concentration of citric acid present in 600ml novida was **0.013**M. And contains 2.5 gram of citric acid in each liter of novida

Table 11: Quantification of Acid Concentration In

PILOT	1	2	3
FINAL VOLUME(cm^3)	2.80	3.20	3.00
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	2.80	3.20	3.00

AVERAGE VOLUME USED=3.00cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (malic acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M

VA; volume of acid (malic acid) = 10ml

VB; volume of base (sodium hydroxide) = 3.00cm^3

$C_4H_6O_{5(aq)} + 2NaOH \longrightarrow C_4H_4O_5Na_{2(aq)} + 3\ H_2O_{(l)}$

Therefore; nB: number of mole of base (NaOH) = 2 and nA: number of mole of acid (malic acid) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times3\times1}{10\times2} = 0.02M$

Amount in g/l = molarity $\times$ molar mass =134 $\frac{g}{mol} \times 0.02 \frac{mol}{l} = 2.68 \frac{g}{l}$

- *Conclusion:* The concentration of malic acid present in 600ml 7UP was **0.02**M. And contains 2.68 gram of malic acid in each liter 7UP

Table .12: Quantification of Acid Concentration In 7up (Citric Acid)

PILOT	1	2	3
FINAL VOLUME(cm^3)	2.80	3.20	3.00
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	2.80	3.20	3.00

AVERAGE VOLUME USED=3.00cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (citric acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M
VA; volume of acid (citric acid) = 10ml
VB; volume of base (sodium hydroxide) = 3.00cm^3

$C_6H_8O_7 + 3NaOH \longrightarrow C_6H_5O_7Na_3 + 3H_2O$

Therefore; nB: number of mole of base (NaOH) = 3 and nA: number of mole of acid (Citric acid) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times3\times1}{10\times3} = 0.01M$

Amount in g/l = molarity $\times$ molar mass =192 $\frac{g}{mol} \times 0.01 \frac{mol}{l} = 1.9 \frac{g}{l}$

- *Conclusion:* The concentration of citric acid present in 600ml 7UP was 0.01M. And contains 1.9 gram of citric acid in each liter of 7UP.

Table 11: Quantification of Acid Concentration in Mo Xtra(Citric acid)

PILOT	1	2	3
FINAL VOLUME(cm^3)	13.50	13.40	13.50
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	13.50	13.40	13.50

AVERAGE VOLUME USED=13.50cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (citric acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M
VA; volume of acid (citric acid) = 10ml
VB; volume of base (sodium hydroxide) = 13.5cm^3

$C_6H_8O_7 + 3NaOH \longrightarrow C_6H_5O_7Na_3 + 3H_2O$

Therefore; nB: number of mole of base (NaOH) = 3 and nA: number of mole of acid (Citric acid) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times13.5\times1}{10\times3} = 0.05M$

Amount in g/l = molarity $\times$ molar mass =192 $\frac{g}{mol} \times 0.05 \frac{mol}{l} = 9.5 \frac{g}{l}$

- *Conclusion:* The concentration of citric acid present in 250ml of MO Xtra was **0.05**M. And contains 9.5 gram of citric acid in each liter of MO Xtra.

Table 12: Quantification of Acid Concentration in Azam Energy (Citric Acid)

PILOT	1	2	3
FINAL VOLUME(cm^3)	11.50	11.40	11.50
INITIAL VOLUME(cm^3)	0.00	0.00	0.00
TITRE VOLUME(cm^3)	11.50	11.40	11.50

AVERAGE VOLUME USED=11.50cm^3

From the formula

$\frac{MAVA}{MBVB} = \frac{nA}{nB}$ Where MA; molar concentration of acid (citric acid) =?

MB; molar concentration of base (sodium hydroxide) = 0.1M
VA; volume of acid (citric acid) = 10ml

VB; volume of base (sodium hydroxide) = 11.5cm^3

$C_6H_8O_7 + 3NaOH \longrightarrow C_6H_5O_7Na_3 + 3H_2O$

Therefore; nB: number of mole of base (NaOH) = 3 and nA: number of mole of acid (Citric acid) = 1

Then, MA = $\frac{MBVBnA}{VAnB} = \frac{0.1\times11.5\times1}{10\times3} = 0.04M$

Amount in g/l = molarity $\times$ molar mass =192 $\frac{g}{mol} \times 0.04 \frac{mol}{l} = 7.7 \frac{g}{l}$

- *Conclusion:* The concentration of citric acid present in 250ml of azam energy was **0.04**M. And contains 7.7 gram of citric acid in each litre of azam energy.

Table .13: Acids quantification in g/l and mole/l 1

Soft drinks	Acid quantified	concetration in gram/litre	Concetration in mole/litre
Coca cola	Phosphoric acid	0.78	0.008
	Citric acid	1.54	0.008
Novida	Malic acid	2.68	0.020
	Citric acid	2.5	0.013
7UP	Malic acid	1.9	0.010
	Citric acid	2.68	0.020
MO Xtra	Citric acid	9.5	0.050
Azam energy	Citric acid	7.7	0.040

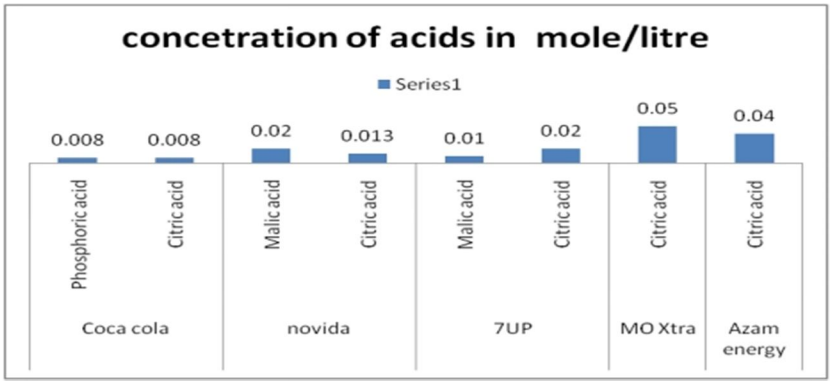

Fig 3.3: Concetration of acid in mole/litre

Analysis: the figure 3.2, analysis shows mo xtra have high concetration of citric acid compared to other soft drinks

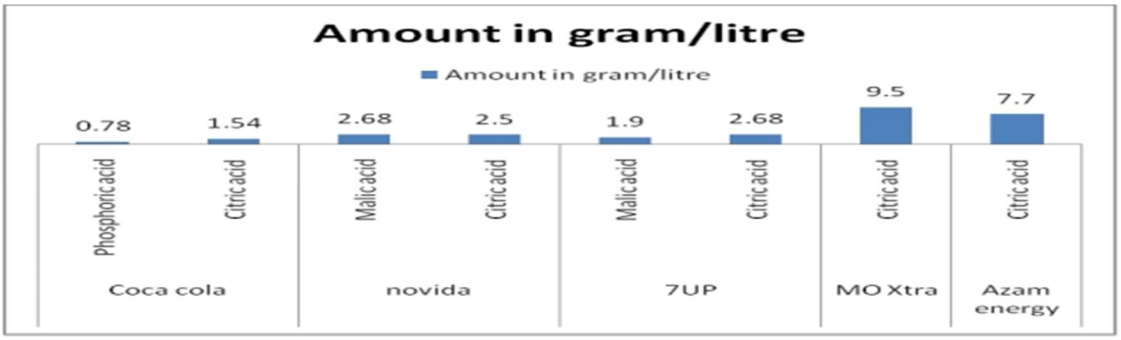

Figure 3.4: Amount in gram /litre

Analysis: The results shows that there is high concetration of citric acid in gram per litre in mo xtra and azam energy compared to other soft drinks.

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IV. DATA ANALYSIS, PRESENTATION, INTERPRETATION, DISCUSSION AND RESULTS

A. Data Analysis and Interpretation

There two types of statistical methods used in this study to analyse and interpret data collected.

- Descriptive statistics
- Chi-square test

1) Research Instruments

The self-administered and well-developed questionnaire was used as the method of inquiry from the respondents.

a) Q1.Gender of the Respondent?

Table 4.1: Gender of the respondent

Assigned number	Gender	Frequencies	Percentage (%)
1	Female	30	50
2	Male	30	50
3	Total	60	100

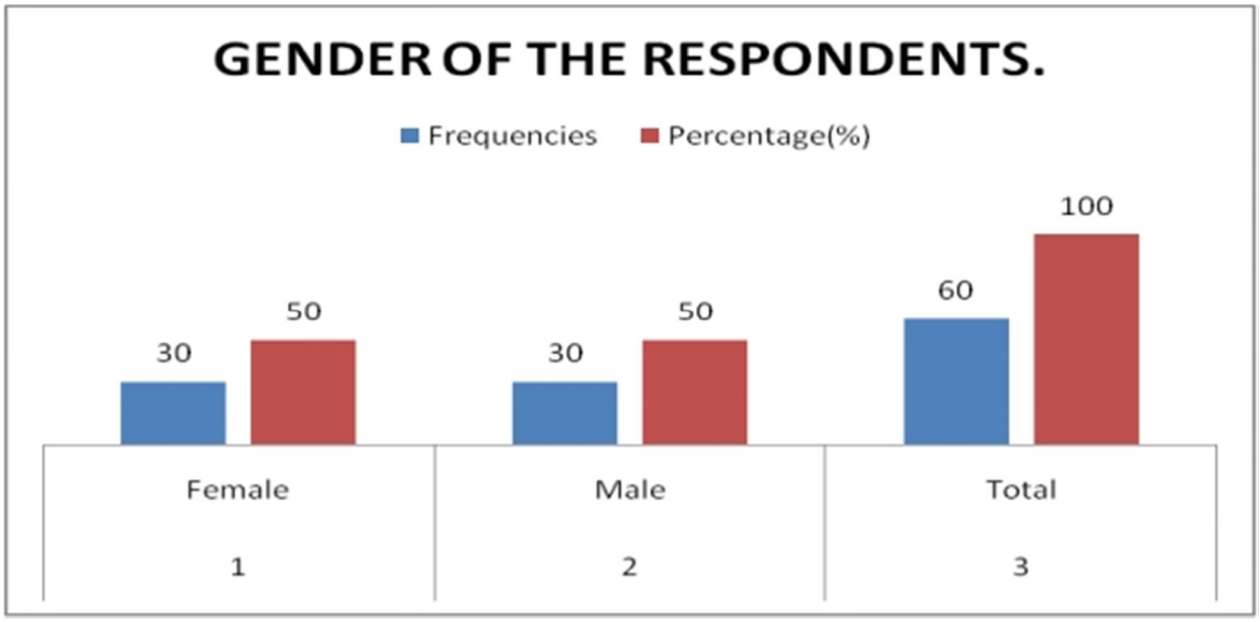

Fig. 4.1: Gender of the respondents

- *Analysis:* Figure 4.1 and table 4.1 show that among 60 respondents on whom survey was conducted 50% are male and 50% are female.

b) Q2: What is your age range? Select your age Range, and put a tick on a correct range

Table 4.2: Age of the respondent.

Age Range of respondents	frequencies	Percentage(%)
18-25 years	32	53.33
26-33 years	22	36.67
34-41 years	06	10.00
Total	60	100.00

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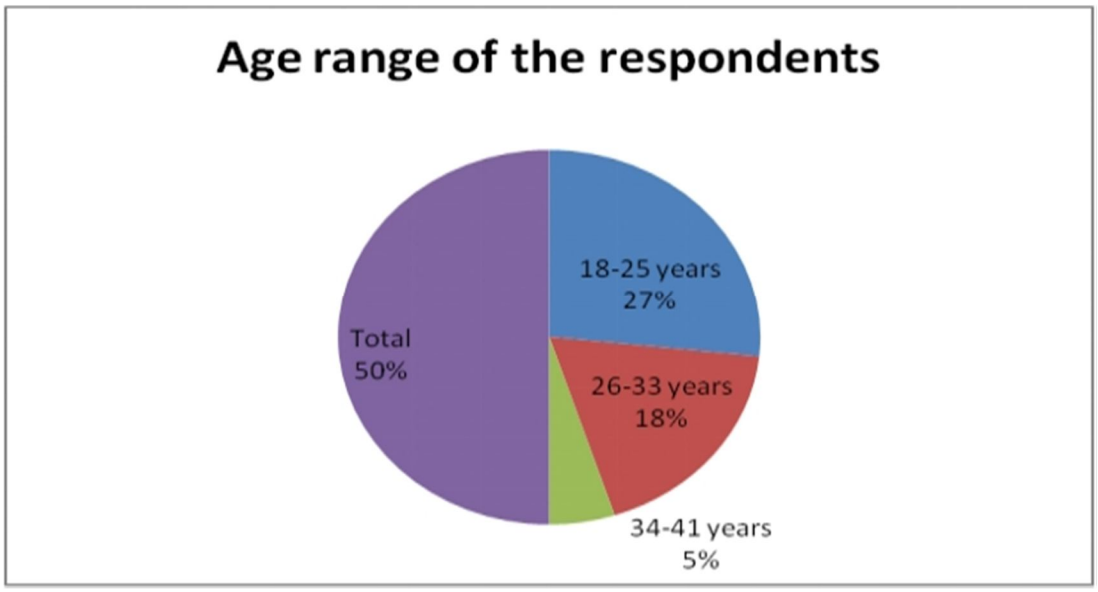

Figure. 4.2: Age range of respondents

- *Analysis:* Figure 4.2 and table 4.2 show that among 60 respondents on whom survey was conducted 27% out of 50% are soft drinks consumers of age from 18-25 years means they are mostly soft drinks consumers and 34-41 are less consumers of soft drinks with 5% out of 50%.

c) Q3: Do you like soft drinks?

Table 4.3: Fond of soft Drinks.

Fond of soft drinks	Frequencies		Percentage (%)
Gender	male	female	
Yes	25	17	70
No	7	11	30
Total	60		100

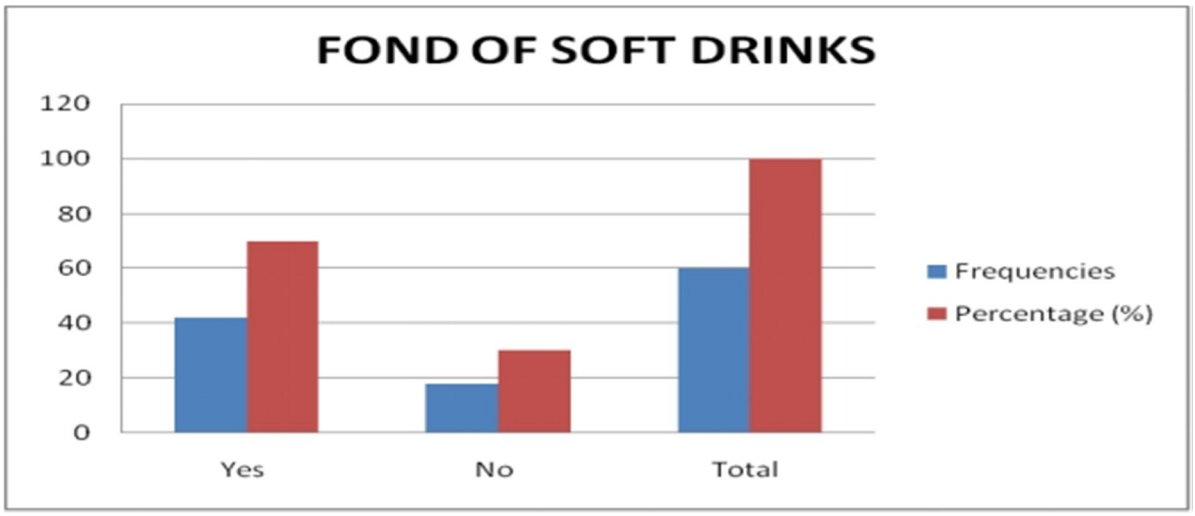

Fig. 4.3: Fond of soft drinks

- *Analysis:* From the survey, it was found that among **60** respondents **70%** of the people like soft drinks and **30%** of people do not like soft drinks. Table 4.3 and figure 4.3 shows how soft drinks attracting people by their taste, flavors, smell, colors etc.

d) Q4: what is your preferable flavor of soft drinks?

Table 4.4: Preferences of soft drinks

Preference of soft drinks	Number of people		Percentage(%)
Gender	male	female	
Azam energy drink	06	02	13.33
MO extra	05	01	10.00
Novida	07	11	30.00
7UP	05	06	18.33
Coca cola	06	06	20.00
Others	02	03	8.33
Total	60		100

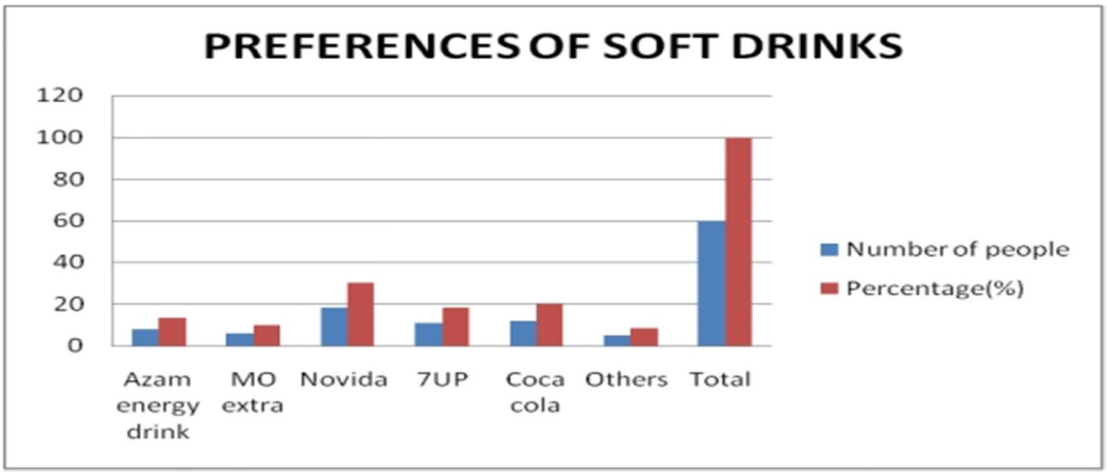

Figure 4.4: Preferences of soft drinks

- *Analysis:* The results of the survey showed that 13.33% of the respondents among 100% preferred azam energy drink,10% preferred MO extra, 30% preferred Novida, 18.33% preferred 7up,20% preferred Coca cola and 8.33% out of 100% preferred other drinks which are not listed in the sample. There for from the selected sample novida and coca cola are mostly preferred compared to other soft drinks as show in table 4.4 and figure 4.4.

e) Q5: What is the main reason (s) you choose to consume such soft drink?

Table 4.5: Reason for consuming the soft drink

Reasons for consuming soft drink	Frequencies		Percentage (%)
Gender	male	female	
Good taste/ flavour	04	06	16.67
Stimulate the body	05	04	15.00
Affordable	03	03	10.00
Availability	03	01	06.70
Quenching thirsty	02	04	10.00
Occasion	03	05	13.33
Good smell	03	02	8.33
Others	01	04	8.33
Without any reason	04	03	11.67
Total	60		100

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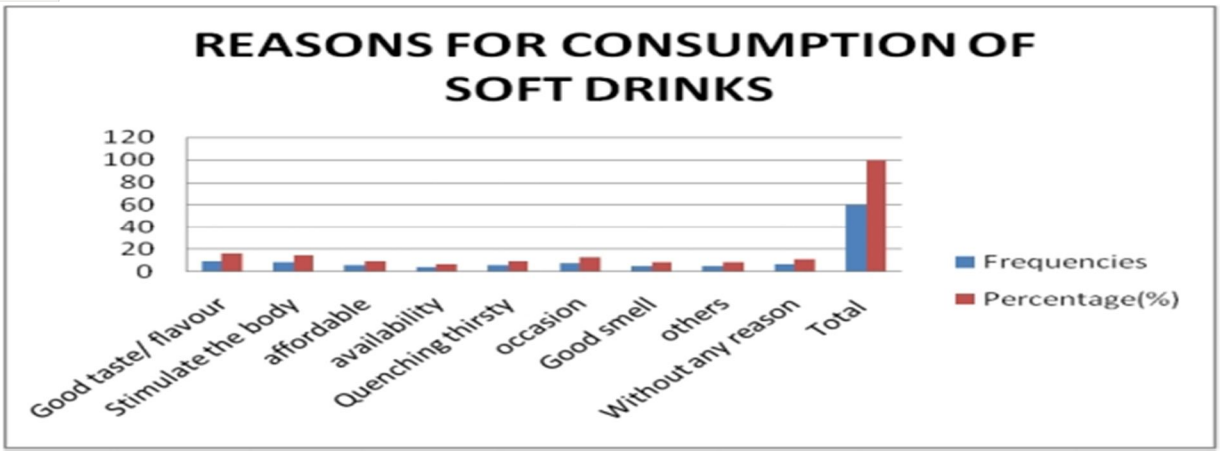

Figure 4.5: Reasons for consumption of soft drinks

- *Analysis:* The results of the survey shows that among 60 respondents,16.67% consume soft drinks of their taste and flavour, 15% consume soft drinks because of thinking it stimulates the body parts such as brain, 13.33%consume soft drinks on different occasions such as parties and celebration and 11.67% of respondents consume soft drinks with no reason.

f) Q6: Do you always read the ingredients list on the back of soft drinks?

Table4.6: Awareness of soft drinks ingredient

Do you always read ingredient list on the back of soft drinks	frequencies		Percentage(%)
Gender	male	females	
Agree	06	09	25
Strongly agree	04	04	13
Disagree	19	06	42
Strongly disagree	07	05	20
Total	60		100

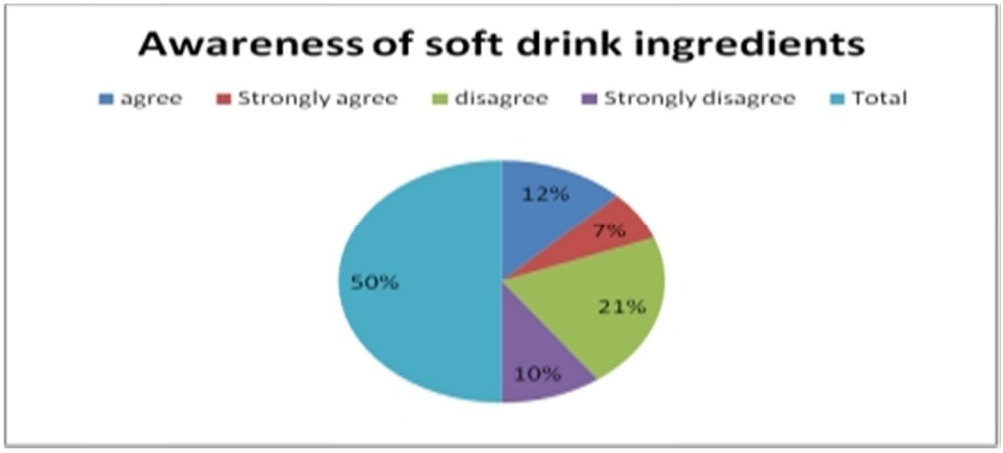

Fig 4.6: Awareness of soft drink ingredients

- *Analysis:* The results depicted in figure 4.6 and table 4.6 showed that 13% of the respondents reads the written ingredient in soft drinks and 42% do not read the written ingredients in soft drinks. This implies that most of the respondents do not read the ingredients written in soft drinks they just take it.

g) Q7: How often do you consume soft drinks?

Table 4.7: Intake of soft drinks

Intake of soft drinks	Frequencies		Percentage (%)
gender	male	female	
Per day	10	08	30.00
Per week	18	14	53.33
Per month	02	08	16.67
Total	60		100

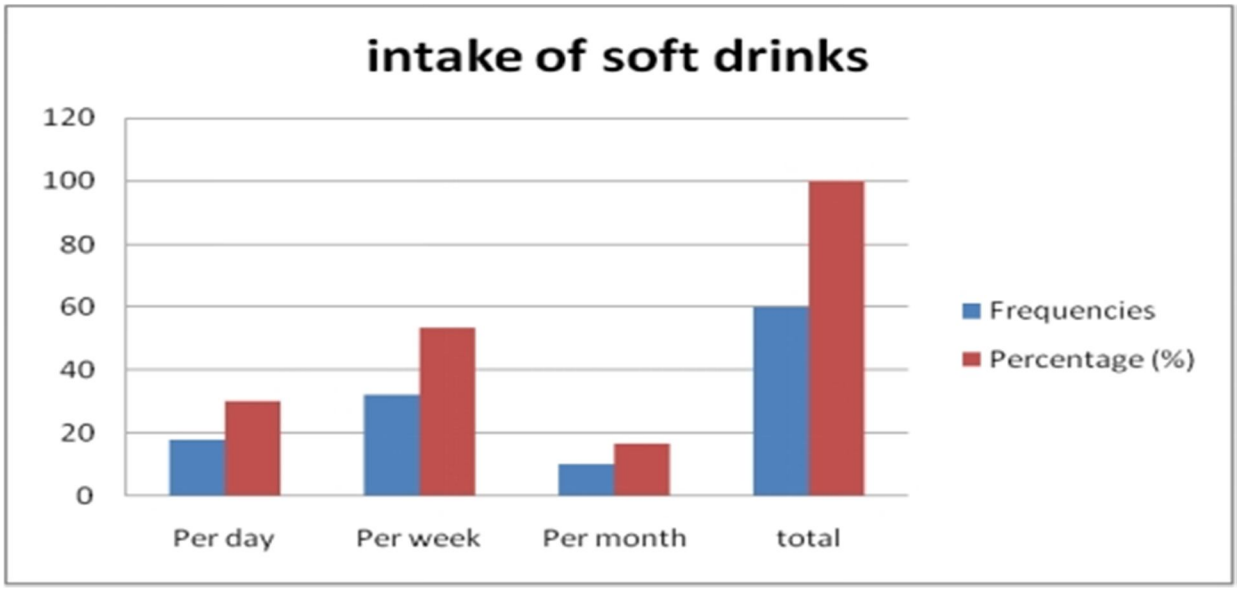

Figure: 4.7: Intake of soft drinks

- *Analysis:* The results depicted in figure 4.7 and table 4.7 showed that 53.33% of the respondents takes in soft drinks only per week and 30% takes soft drinks per day and 10% per month. Means that soft drink consumers takes in soft drink more in every week.

h) Q8: How much do you consume soft drink in a week?

Table 4.8: Frequency of consumption of soft drink in a week.

Frequency of consumption of soft drink in a week	Frequencies		Percentage (%)
Gender	male	female	
Daily	04	02	10.00
2 to 4 times	07	03	16.67
More than 4 times	01	02	5.00
Once in a week	10	13	38.33
Others	08	10	30.00
Total	60		100

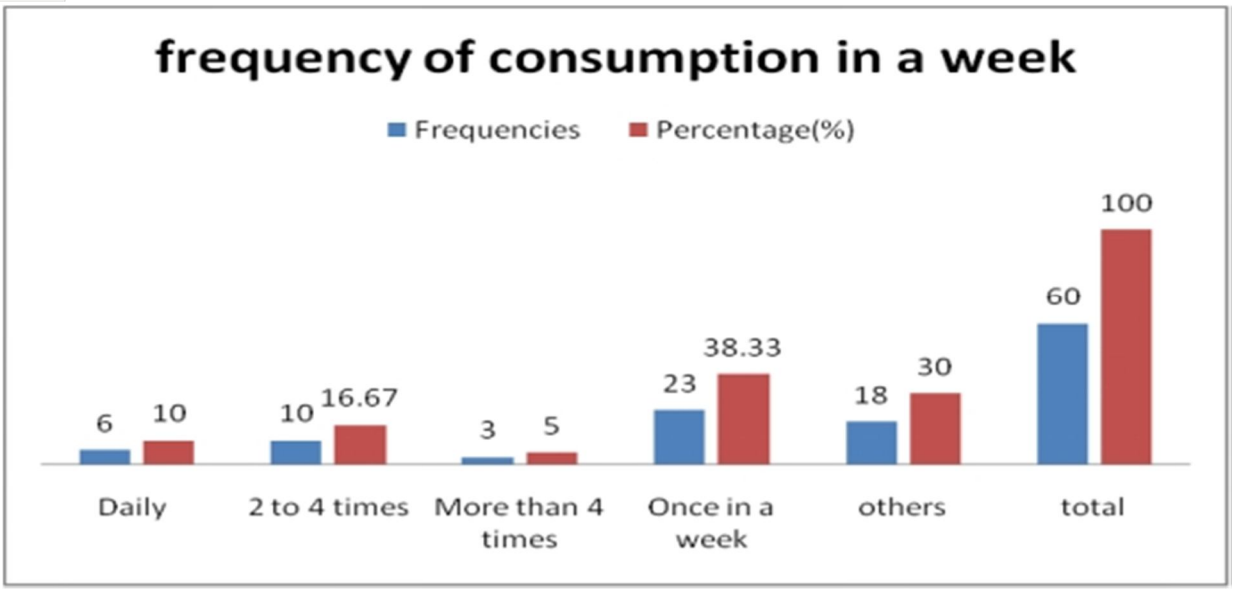

Fig: 4.8: Frequency of consumption in a week

- *Analysis:* when the frequency of consumption of soft drinks were studied among 60 respondents; results showed that 10% of the people consumed soft drinks daily, 16.67% consumed soft drinks in 2 to 4 times per week, 5% consumed soft drinks more than 4 times per week, 38.33% consumed soft drinks once in a week (figure 4.8, table 4.8). It is surprising to know that nobody is there among 60 respondents who do not like soft drinks.

i) Q9. Do you think taking too much soft drink would cause health problems? If NO skip question number 10

Table 4.9: Does soft drinks cause health problems.

Health problem due to soft drink	frequencies		Percentage (%)
Gender	male	female	
Yes	13	15	46.67
No	14	18	53.33
Total	60		100

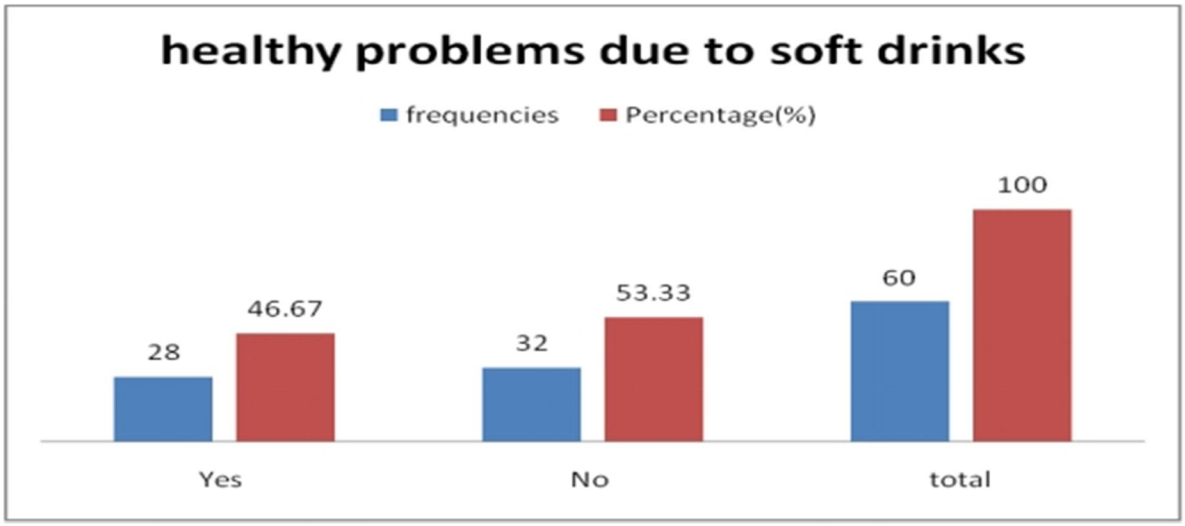

Figure: 4.9: Healthly problems due to soft drinks

- *Analysis:* The results of the survey presented in figure 4.9 and table 4.9 showed that, 46.47% of respondents are well aware of the health problems caused by soft drinks, only 53.33% of the respondents are unaware of the health issues caused by soft drinks. Means the large number of people are not aware on the health effects due to soft drinks.

j) Q10: what action(s) will you take to minimize the health effects of soft drinks?

Table 4.10: Action to minimize the health effects of 1 soft drinks.

Action to minimize health effects due to soft drink	frequencies		Percentage (%)
Gender	male	female	
Reduce consumption	07	09	26.67
Avoid consumption	02	00	3.33
Intake alternative drinks like water and fresh fruit juice.	04	06	16.67
Skipped question	19	13	53.33
Total	60		100

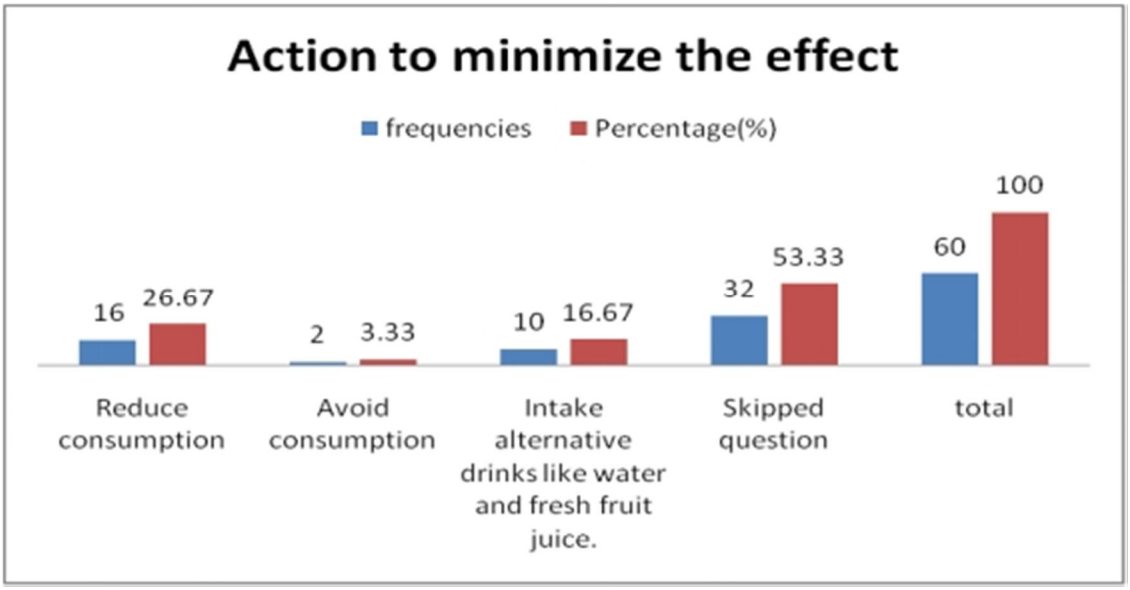

Figure: 4.10: Action to minimize the effect

- *Analysis:* The results from the survey show that; 3.33% of the respondents takes action to avoid the consumption of soft drink in order to minimize effect, 26.67% of the respondents reduce the consumption of soft drinks , 16.67% takes alternative drinks like water and fresh fruit juice, and 53.33% skipped the question. Therefore it revealed that majority are unaware of health effects of too much consumption of soft drinks.

k) Q11: is Questionnaire useful to you?

Table 4.11: Is it a useful questionnaires?

Is questionnaires useful to you?	Frequencies	Percentage (%)
Yes	55	91.67
No	05	8.33
Total	60	100

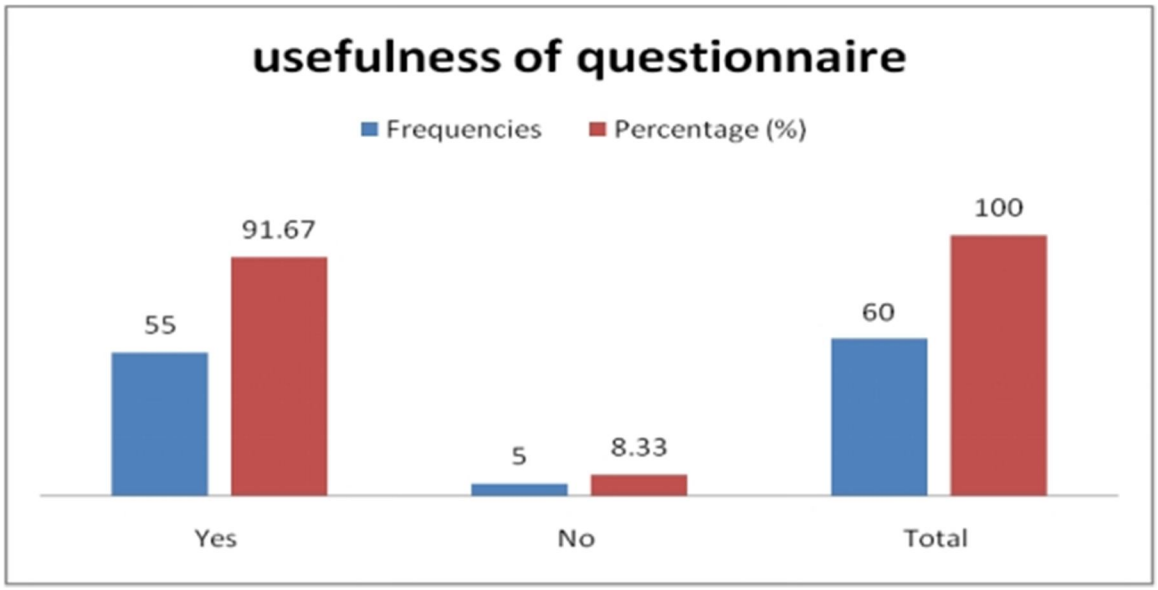

Figure: 4.11: Usefulness of questionnaire

- *Analysis;* According to the results of the survey presented in figure 4.11 and table 4.11, 91.67% of respondents thinks that the it is a useful questionnaire and 8.33% of them thinks that some more questions are to be added.

2) The Chi-square test

The Chi-square test of independence also known as the person, Chi- Square test, or simply the Chi-Square) is one of the most useful statistics for testing hypothesis when the variables are nominal or ordinal. The Chi-square statistics is testing relationship between categorical variables. The null hypothesis of the chi-Square test is that no relationship exists between the categorical variables in the population; they are independent. The formula for calculating a chi-square is

$X_c^2 = \varepsilon \frac{(Oi-Ei)2}{Ei}$ where:

O observed value.

E expected value

C degree of freedom calculated as degree of freedom =(r-1)(c-1)

3) Hypothesis and Testing

a) Null Hypothesis: There is no association between choices of soft drinks and why do you drink soft drinks.

b) Alternative Hypothesis: There is association between choices of soft drinks and why do you drink soft drinks.

c) Level of Significant: $\alpha = 0.05$

Table 4.12: Association between choices of soft drinks and consumption of soft drinks

Test statistics	Chi-square value	Degree of freedom	Critical value
Do you like soft drinks?	30.0466837	1	3.84145915
What is your preferable flavor of soft drinks?	85.82444	5	11.0704978
What is the main reason (s) you choose to consume such soft drink?	20.74931	8	15.50731306
How often do you consume soft drinks?	57.77802	2	5.991465

How much do you consume soft drink in a week?	13.09497	4	9.487729
Do you always read the ingredients list on the back of the soft drink?	49.49429	3	7.814728
Do you think taking too much soft drink would cause health problems? If NO skip question number 10	13.08975	1	3.841459
What action(s) will you take to minimize the health effects of soft drinks?	18.46607	3	7.814728
Total	288.5435		65.36938

- *Interpretation:* From the provided evidence all the critical values are less than the chi square value ($CV<X^2$). If the chi square value is large than the critical value, then we reject the null hypothesis (HO) and the alternative hypothesis (HA) considered. Therefore, there is association between choices of soft drinks and why do you drink soft drinks.

B. Discussion

The research aimed to determine contents of soft drinks and their impact on health this was done through different experimental method which gives positive results of glucose, alcohol,alkaloids, lead, cadmium, PH, Carbon dioxide and sucrose which are the main contents found in soft drinks. Also the survey was conducted through questionnaire method based on 60 respondents, figure 1 and table1 show that among 60 respondents on whom survey was conducted 50% are female and 50% are male . Among 60 respondents 53.33% are of age range from 18 to 25 as shown in figure 2 and table 2. This implicates that the surveyed age range (18-25) are good consumers of soft drinks in large percentage.

From the survey, it was found that among 60 respondents 70% of respondents likes soft drinks and 30% of the respondents do not like soft drinks, table 5 and figure 5 shows how soft drinks attracting people by their taste, flavour, colour, stimulation, affordability, and smell. The results of the survey showed that 13.33% of the respondents among 60 preferred azam energy drink, 10% of the respondents among 60 preferred MO Xtra, 30% of the respondents among 60 preferred Novida, 18.33% of the respondents among 60 preferred 7UP,20% of the respondents preferred coca cola and 8.33% preferred other soft drinks,(figure 4 & table 4).

When the frequency of consumption of soft drinks was studied among 60 respondents, the results showed that 30% of the people consumes soft drinks per day, 53.33% consumes soft drinks per week while, only 16.67% of the respondents take in soft drink per month. The results indicate that large number of people consume soft drinks per week (table 6 & figure 6).

Based on consumption of soft drinks in a week, the survey showed that 10% of respondent take in soft drinks daily in a week, 16.67% of the respondents take in soft drinks 2 to 4 times, 5% of the respondents among 60 take in soft drinks more than 4 times in a week, 38.33% of the respondents take in soft drinks once in a week and only 30% of the respondents are other takers of soft drinks out of a week (figure 7 & table 7).This results implies that, large percentage of respondents take in soft drinks once in a week and surprising to know that nobody is there among the respondents who do not like soft drinks.

On studying the awareness of soft drinks takers on health problems due to soft drinks, table 8 and figure 8 of the surveyed respondents, 46.67% of the respondents are aware of the health problem due to soft drinks and 53.33% are not aware about the health problems due to much consumption of soft drinks. Therefore this research is more important so as to makes people aware on health problems like kidney problem, heart problem, bones problem, diabetes, weight gain and teeth decay as the mainly health problem arose due to soft drinks.

Also table 9 and figure 9 show that among 60 respondents 26.67% will takes action on reduce consumption of soft drinks, 16.67% of the respondents said that they will use alternative drinks like water and fresh fruits juice so as to reduce the health problems due to soft drinks while 53.33% of the people skipped the question since they are not aware of the health problems due to soft drinks. Therefore the majority of the respondents are not aware about the health problems due to soft drinks.

According to the results of the survey presented in figure 10 and table 10, 91.67% of the respondents thinks that this questionnaires are useful to them and 8.33% of the respondents thinks that some more questions should be added.

C. Results

After conducting several tests, it was concluded that different brands of soft drinks namely azam energy, mo xtra, novida, coca cola and 7 up.

All soft drinks found to be contained with glucose, phosphate, sucrose, alcohol trace, carbon dioxide, lead, cadmium, caffeine, narcotics alkaloids. All are acidic in nature, on comparing the pH value of different brand coca cola is the most acidic soft drink (pH = 2.3) while azam energy is the least acidic soft drink with pH value of 4.4. pH value of coca cola is nearly equal to disinfectant which is harmful for the body. Among the five samples of soft drinks taken azam energy has a maximum amount of dissolved carbon dioxide gas and 7UP has a minimum amount of dissolved carbon dioxide.

Consumption of soft drinks in high quantities, results to major diseases like obesity, tooth corrosion, bone loss, kidney and liver disease and gastro intestinal disease, this results as in large consumption of soft drinks contents.

1) *Phosphoric Acid:* soft drinks contain phosphoric acid which has a PH value of 2.8, phosphoric acid interferes with the body's ability to use calcium(bone loss), possibly leading to the weakness of teeth and works to neutralize hydrochloric acid in the stomach, thus interfering with proper digestion of nutrients in food.
2) *Sugar:* high glucose consumption rapidly will elevates blood glucose and insulin. This may cause type 2 diabetes and cardiovascular disease. All sugars has more calories calories and can cause people to gain weight which leads to obesity. High consumption of soft drinks can lead to tooth decay due to presences of high concentration carbohydrates and simple sugars. When high amounts of sugar enter into the stomach, pancreas, have to produce more insulin, which sends more fat to fatty cells, muscles cells, liver, which leads to different liver diseases.
3) *Carbon Dioxide:* The gas used to make soda bubbly is the same poison we eject out of our bodies through our lungs. This gas is great for plants but it is bad news for human beings.
4) *Caffeine:* caffeine disturbs sleep by stimulating nervous system, it makes premenstrual syndrome worse, causes dehydration and induces stomach to produce acids aggravating hyper-acidity and causes insomnia, irregular heartbeat and high blood pressure.
5) *Acidic Value/ PH Value:* The PH of soft drinks range from 2.2-4.0 which generates a highly acidic environment in the stomach upon consumption. The PH levels are due to presences of carbon dioxide and phosphoric acid which makes the drink highly acidic and can led an effect on gastro-intestinal system. Also the higher acidic nature can led to tooth enamel, phosphoric acid oxidize or corrodes the tooth covering by lowering the bone density.
6) *Cadmium and Lead:* These are heavy metals found in some of tested soft drinks, cadmium is a heavy metal whose long term of accumulation may lead to cancer since it is a carcinogenic element. Also, over a long intake of soft drinks with cadmium may accumulate in the kidney and liver and cause liver and kidney problems, while lead can lead to the damage of the brain and nervous system as well as kidney problem.

Some soft drinks such as coca cola and Novida tested and found to be contained with Narcotic alkaloids like morphine, cocaine, etc. which gives a positive test with Meyer's reagents. The narcotics alkaloids associates with psychoactive compound with numbing or paralyzing properties. Other effects include mental fog, nausea and constipation.

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

Soft drinks are among the most commonly adopted drink around the world, owing to their great taste. Results from this study show that, soft drinks contains contents such as sugar, heavy metals, alkaloids, carbon dioxide, citric acid, malic acid, alcohol trace and phosphates. Everything has two aspects, positive or negative, Soft drinks have also positive as well as negative effects on health, soft drinks can hydrate the body, they are eases digestion and prevents stomach pain, it provide a slight caffeine boost that can be healthy in moderation of brain. Despite of those positive effects, soft drinks have negative effects on their excessive consumption and this arose a questions on human health, analysis of this study shows that large percentage of people of age range of 18-35 consumes the soft drinks more than once in a week ,they takes soft drinks for refreshment, taste preference for price and others for thinking that they are energize their bodies, the consumption was based on their choice of a drink which they like without any awareness of health effect caused by high consumption of soft drinks. The excessive use of soft drinks in daily life not only destroys physical health but also associated with disease such as liver damage, kidney failure, obesity, diabetes, teeth decay etc.so consumers requires further education on consumption amount of soft drinks and their potential effects on their health.

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B. Recommendations

It can be difficult to kick the habit of drinking soft drinks every day but, it can be easier when there are alternatives to replace with natural drinks such as natural fruit juices, milk and water. Also people can use honey instead of sugar on their homemade smoothie drinks to make them healthier and reduced the risk of obesity, tooth decay, heart diseases and diabetes. For health purpose, we recommend that people should reduce consumption of soft drinks by either taking one bottle of a drink than take more every day, since some respondents especially adults took three to four energy drinks.

Parents can help their children, learn to enjoy water as the thirst quencher of choice. Also provided them with a variety of low-fat milks and fruit juices that are high in nutrients values than sugary soft drinks.

Schools can advocates for healthful environments that are consistent with classroom nutrition education and teacher being role models should advice students on taking healthy beverage choices such as natural fruit juices etc.

We would like to suggest the government to continue do frequent quality check at industry level, in order to increases the quality and definite standards of various soft drinks during the production.

In summary, all stake holders including the soft drink companies, governments, parents and teachers should all play a concerted and critical role towards solving the health problems related to soft drinks consumption with the sole aim of “prevention is better than cure”

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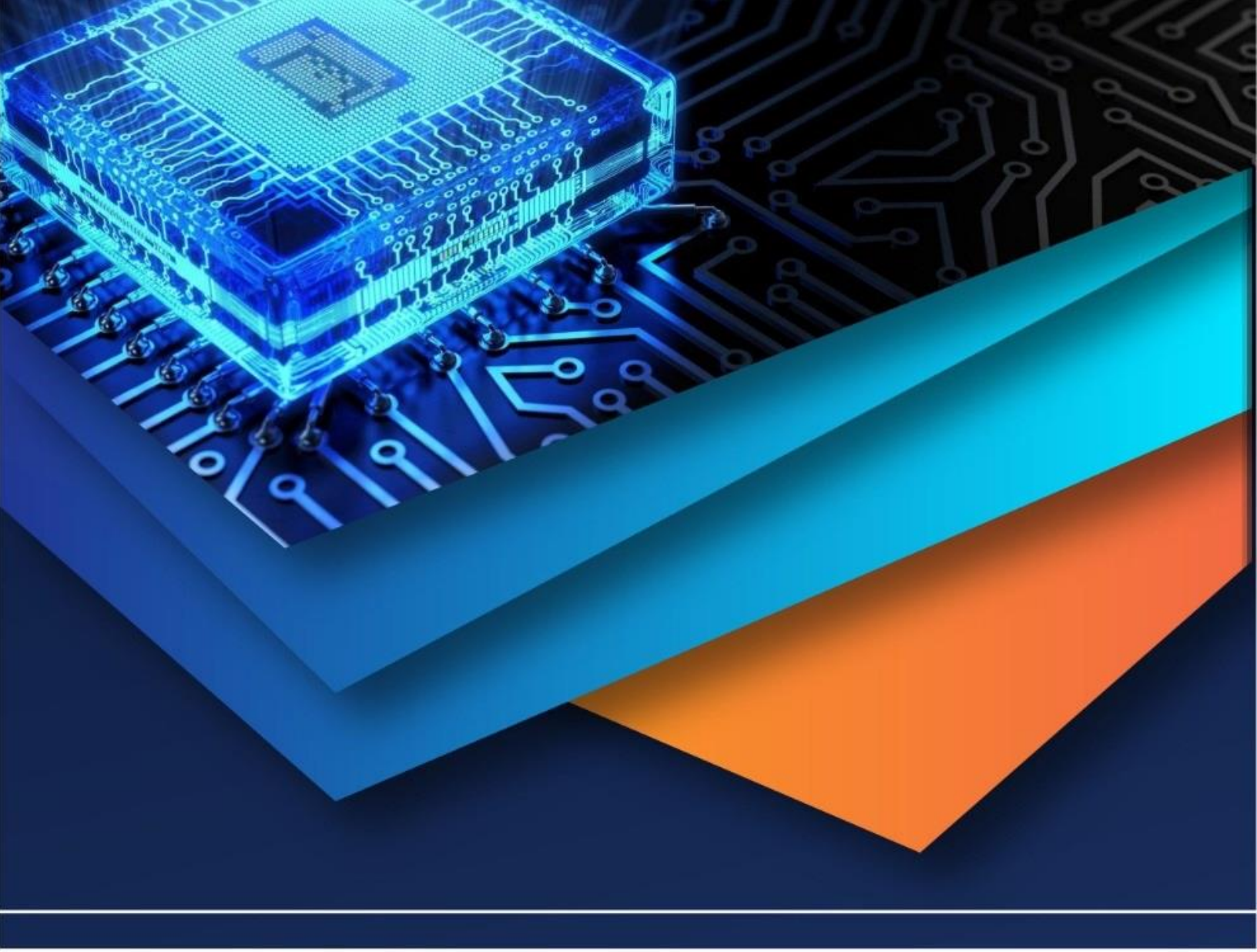

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