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Replacement of Chemical Components in Energy Drinks Using Biological Alternatives

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Abstract: Energy drinks are widely used all over the world as an energy booster or stimulant. It contains chemicals like caffeine, taurine, excess amount of Vitamin B, ginseng, and sugar which cause different human disorders when consumed on regular basis. Herbs are types of plants with redolent or aromatic properties; herbs are used to savor food and are also used in medicines. Herbal compounds are a good source of several nutrient elements essential for the metabolic process. Herbs have wide applications in energy drinks. Herbs like lemon Grass, mint, rosemary, Ashwagandha are used significantly. The current study proposes a way to replace chemical compounds in energy drinks with herbal extract. Natural herbal extracts like rosavin, rosarian, phenols are extracted; other properties like the texture of the drink, color, pH, taste, odour were also monitored.

Keywords: Energy Drink, Herbal, Golden Root, Shatavari, Cost, Healthy, Caffeine, Taurine

I. INTRODUCTION

Consumption of energy beverages has been increased on a large scale in the past few decades specifically among young people and adolescents. Energy drinks are the form of products produced in liquid form that contain a high amount of caffeine with or sometimes without added supplements. Research has confirmed high usage of energy drinks has addicted young adults to alcohol-related issues and heavy alcohol consumption. The first popular energy drink was Red Bull which was established in 1997. It is currently the leading energy drink industry in the world. According to WHO, consumption of energy beverages in the year 2013 surpassed 5.8 billion liters in around 170 countries.[2] These drinks are produced to give "Energy Boost" to those who drink by having an amalgam of high stimulants and boosters. Most of the energy drink brands in the market use a high amount of artificial sweeteners and harmful chemicals like taurine, methylxanthine, excess vitamin B, maltodextrin, and inositol. These constituents have led to various probable adverse effects such as cardiovascular problems, unhealthy neurological and physiological conditions, gastrointestinal and metabolic problems, etc. Various issues have been raised about the safety of the drink. This issue should be pinpointed and should be resolved.

Herbal drinks are part of an ideal diet; they improve the antioxidant level and strengthen overall health status. Herbal drinks are abundant in natural bioactive compounds like phenolic acid, coumarins, carotenoids, polyacetylenes, terpenoids, flavonoids, and saponins. Available scientific research signifies that natural bioactive compounds provide various biological effects such as antibacterial, vasodilatory action, anti-inflammatory, antioxidant, antiallergic, antiviral, antithrombotic, and anti-aging effects. There are various herbs used to make herbal drinks in the required proportion. The most nutritious herbs include ginseng, Rhodiola Rosea, guarana, yerba mate, Shatavari, Ashwagandha, Brahmi, shankhpushpi, Arjun sal, Jethimadh, Guduchi, soy milk powder, etc. Natural availability, easy formulation, beneficiary effects for various diseases, mood enhancement, healthy lifestyle are the principal reasons for heightened interest in an herbal energy drink.

When it comes to herbal drinks, they are derived from natural sources like food items, herbs, and minerals. They do not show immediate effects like performance-enhancing drugs do. Herbal drinks act slowly and naturally and target improving overall health and strength. Herbal drinks provide safe and effective options to increase body strength, improved endurance, increase physical stamina, and hydrate the body. According to healthcare in India, up to 80% of people in India use some form of traditional medicine which includes herbs.[10] Considering the market acceptance in the Indian subcontinent and even outside India, the components were finalized. Herbs not only provide energy but also help in rebuilding body tissues and restoring lubricating fluids.

The novelty of the product can be justified as there isn't any other product worth available in the market with all these ingredients and which promises such a varied range of advantages. The target group can be children, youth, and younger adults from an age range of 5-50 years. Others can also consume the drink for their benefit.

II. PROPOSED SOLUTION

A healthy energy drink has no side effects or fewer side effects. Here chemical energy drink is replaced by herbal drink. Harmful chemicals like taurine, caffeine, accident, artificial sweeteners, and artificial flavors are replaced by natural herbs like Shatavari, golden root (*Rhodiola Rosea*) lemon, jaggery, fruit juice respectively with coconut water as the main base. This drink is natural, inexpensive, efficient, and increases body performance.

III. MATERIALS AND METHODS

A. *Rhodiola Rosea* Extraction

A Soxhlet extractor is a laboratory apparatus originally designed for the extraction of an organic compound from solid material. Soxhlet extractor is used when the desired compound has limited solubility in a solvent, and the impurity is insoluble in that solvent.

1) Sections of Soxhlet Extractor

A percolator circulates the solvent.

A thimble is made by packing powder in filter paper.

Siphon mechanism is used to empty the chamber.

2) Assembly

Rhodiola Rosea was packed in filter paper and placed inside the thimble.

The thimble was loaded onto the round bottom flask.

Ethanol was added to the round bottom flask.

The round bottom flask was placed on the heating mantle.

Distillation was performed.

3) Operations

180 ml Ethanol was filled in flask and heated.

Solvent vapour travels through distillation chamber housing and floods the thimble.

The chamber is then filled with solvent.

Some of the desired compounds (phenolic) dissolve in the warm solvent; when the Soxhlet chamber is full the chamber was emptied by the siphons.

The solvent was returned to the round bottom flask.

After extraction, the solvent was removed by distillation yielding the extracted compound.

The non-soluble portion of the extracted solid remains in the thimble was discarded.

The extract was evaporated on water bath and dry powder was obtained.



Fig. 1: Rosavin extraction process using soxhlet.

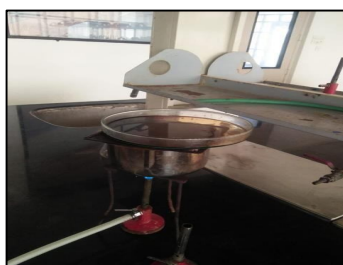


Fig. 2: Heat drying of Rosavin extraction.

B. Shatavarin Extraction

Collection and extraction:

Asparagus racemosus wild (Shatavari) root powder was purchased online from the IndiaMART website.

The dried powder was boiled at 100°C + 10 for 2 hours.

The extract was filtered using filter paper supernatant was collected and the remaining residue was discarded.

Further supernatant was condensed in the water bath and condensate extracted by methanol.

This methanolic extract was concentrated in a rotary evaporator under reduced pressure at (45°C - 50°C) to avoid the evaporation of useful plant compounds.

This aqueous extract was concentrated using Lyophilizer and stored at 4°C

C. Saponins Estimation Procedure

Weigh accurately 2 gm of the material in a beaker. Add 50ml of petroleum ether in it and slowly heat to 50°C on a water bath for 3-5 minutes with regular shaking.

Filter the petroleum ether and repeat the same process twice using 50 ml of petroleum ether.

Discard the petroleum ether and keep the residue.

Extract the residue obtained in the previous process with 4×60 ml of methanol with gentle heating.

Filter the methanol layer to another beaker.

Concentrate methanol layer to about 25 ml.

Add 150 ml of dry acetone for the precipitation of saponin.

Filter the saponin through filter paper and dry at 100°C for constant weight.

D. Calculation

Percentage of total saponin = Weight of residue/weight of sample taken ×100

E. Vitamin C

Vitamin C was purchased from local medical store. Vitamin C itself acts as preservatives and help to increase shelf life of drink.

Benzoic acid can also be used as preservative.

F. Flavour

Strawberry flavor was purchased from online store.

G. Base

Distilled water is used as base.

H. Sweetner

Jaggery is used as natural sweetener.

IV. FORMULATION

The developed formula for herbal energy drink [250ml] was as follows:

Table 1: Content required for herbal energy drink.

Herbal extract	Amount
Shatavari	1000 mg
Golden Root	80 mg
Vitamin C	90 mg
Jaggery	30 gm
Flavour	As per requirement
Water	250 ml

Table 2: Replaced elements of the drink in market.

Red Bull	Herbal Drink
Caffine	Golden root extract
Acidulant	Vitamin C
Taurine	Shatavarin
Artificial Sweetener	Jaggery
Artificial Flavours	Organic Flavours
Artificial Colours	Organic Colours

V. RESULT AND DISCUSSION

We analyzed the sample from Masters Lab, Gokul Shirgaon, Kolhapur.

Table 3: Amount of content in produced herbal energy drink. Per 250 ml.

Total Calories	102 Calories
Total Polyphenols	46.5 mg
Total Saponins	38 mg
Total Vitamins	6 mg
Total sugar content	12% value

We added shatavarin and rosavin as a replacement of taurine and caffeine respectively.

Also, by formulation we got that both chemical contents can be replaced by herbal ones in exactly same or some greater amount.

Table 4: Amount present in drinks.

Content	Energy drink in market	Present in Red Bull (250 ml)
Caffeine	75-100 mg	80 mg
Taurine	900-1000mg	1000 mg
Sucrose	27-35 g	28 g

So, amount of herbal content in our energy drink was as follows,

Table 5: Replaced amount of content.

content	Herbal energy drink (250 ml)
Rosavin	80 mg
Shatavarin	1000 mg
Jaggery	30 g

As an addition we added Vit C in the same energy drink. Total amount of Vit C added is equal to 80 mg for 250 ml energy drink. Vit C gives instant energy and boosts the immune system.

If there is requirement of special flavours, we can add them directly into the drink. Examples: strawberry.

VI. COST ESTIMATION

Table 6: Cost estimation

No.	Chemical	Market price	Quantity	Total price
1.	Ethanol	50 Rs / lit	300 ml	15 Rs
2.	Sodium Tungstate	945 Rs / 100 g	10 g	94.5 Rs
3.	Sodium Molybdate	500 Rs / kg	2.5 g	1.25 Rs
4.	Phosphoric Acid	75 Rs / kg	5 ml	0.375 Rs
5.	HCL	3.50 Rs / lit	10 ml	0.035 Rs
6.	Lithium Sulfate	59.4 Rs / 10 g	15 g	89 Rs
7.	Methanol	36 Rs / lit	250 ml	9 Rs
8.	Petroleum ether	700 Rs / 500 ml	100 ml	140 Rs
9.	Dry acetone	426 Rs / 500 ml	150 ml	128 Rs
10.	Rhodiola Rosea extract	550 Rs / 1 gm	80 mg	44 Rs
11.	Shatavari extract	25 Rs / 1 g	1 gm	25 Rs
12.	Vitamin C	2 Rs / 500 mg	90 mg	0.36 Rs
13.	Jiggery	40 Rs / 1000 gm	30 gm	1.2 Rs
14.	Distilled water	20 Rs / 1000 ml	250 ml	5 Rs
15.	Plastic Bottle	20 Rs / piece	1	20

Total cost of 250 ml drink is **573 Rs.**

VII. CONCLUSION

A. Effectiveness

Herbal energy drink is also as effective as normal energy drinks present in market.

B. Cost

If we produce it in fewer amounts then cost is relatively higher but mass production can reduce the price.

C. Side Effects

Less long term side effects than normal energy drinks.

D. Production Type

Can be produced in different types as ready to drink, tablet, capsule, liquid solution.

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