Int J Ayu Pharm Chem
ISSN 2350-0204
www.ijapc.com

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Clinical Effects of *Ragi* (Eleusine coracana) *Ayurvediya Krishara* with *Takra* on the physical and Mental Health of Medical and Engineering Male students (18-25 years)

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ABSTRACT

Breakfast plays a critical role in providing the energy required throughout the day. Unfortunately, many urban Indians skip this essential meal, with only 3% considering it vital for their daily routine. Recognizing the importance of a nutritious start to the day, the *ESHIMANI* FOUNDATION initiated a study to evaluate the benefits of incorporating *Ragi*/finger millet (*Eleusine coracana*) *Krishara* with *Takra*, a traditional fermented buttermilk, as a daily breakfast option for undergraduate medical and engineering students aged 18-25 years for 3 months. Millets, particularly *Ragi*, offer a gluten-free, low-glycemic, and antioxidant-rich food source that is easily digestible, while *Takra* provides probiotic benefits that support digestive health.

The study aimed to assess the effects of this dietary intervention on the physical and mental well-being of students, thereby promoting healthier eating habits. The primary results showed significant improvements in the trial group who consumed the millet-based breakfast compared to the control group who maintained their regular breakfast habits. Participants in the trial group experienced enhanced energy levels, improved digestive health, and better cognitive function, indicating the positive impact of this dietary change.

The major conclusion of the study is that by providing an ayurvediya balanced and nutritious start to the day, this dietary option supports both the physical and mental demands of students, encouraging a healthier lifestyle and improved academic performance. This research highlights the potential of traditional, nutrient-rich foods in enhancing overall well-being and fostering long-term healthy eating habits among the youth.

Key Words *Ragi* / finger millet (Eleusine coracana), *Takra, Ayurvediya Krishara, Nutritious Healthy Breakfast, male Medical- Engineering Students*

Received 20th August 2024 Accepted 02nd October 2024 Published 10th November 2024

INTRODUCTION

The primary aim of this study is to evaluate the effects of a specific dietary intervention on the physical and mental well-being of students, with the goal of promoting healthier eating habits among the youth. This intervention is designed to enhance energy levels, improve digestive health, and support cognitive function, thereby underscoring the positive impact of this dietary change on students themselves.

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Medical and engineering students frequently endure rigorous schedules that necessitate prolonged mental focus and physical stamina. Within this context, the significance of nutrition, particularly breakfast, becomes paramount. This study explores the impact of a traditional Indian breakfast, *Ragi Khichadi* or *Ayurvediya Krishara* with *Takra,* on the physical and mental health of students aged 18-25 years.

Millets, especially *Ragi* or finger millet (Eleusine coracana), are small-seeded grains that are rich in vitamins, minerals, and dietary fiber, offering a nutritious alternative to refined grains. They have a low glycemic index, which ensures a steady release of energy, making them particularly beneficial for students engaged in long study sessions. *Takra,* a fermented buttermilk, is noted for its probiotic properties that support gut health and enhance immune function. With increasing health concerns related to poor dietary habits, this study aims to ascertain whether integrating ayurvediya *Ragi Krishara* with Takra into the daily breakfast routine can favorably influence students' health and academic performance.

Krishara (porridge) is recognized in various contexts as a wholesome and easily digestible food. It is prepared by cooking rice with lentils (*dal*) and is often recommended for its nourishing and light properties, particularly for those with digestive issues or needing a light diet post-illness (*Sushruta Samhita; Charaka Samhita*). *Takra* (buttermilk) is extensively documented for its benefits in aiding digestion, reducing inflammation, and balancing the *doshas,* especially *Vata* and *Kapha*. It is prescribed for various diseases, including digestive disorders, and as a daily dietary component (*Charaka Samhita; Ashtanga Hridaya*). *Ragi*/finger millet (*Eleusine coracana)* is also recognized for its nutritional value. It is considered cooling, beneficial for reducing body heat, and suitable for individuals with *Pitta* imbalances.

Targeting students aged 18-25, this study addresses a critical period for establishing lifelong health habits. By introducing a nutritious and time-efficient breakfast, the study seeks to mitigate the unique challenges faced by this demographic, particularly those related to stress, concentration, and overall well-being. The major conclusion of the study is that by providing an Ayurvedic, balanced, and nutritious start to the day, this dietary option supports both the physical and mental demands of students, fostering a healthier lifestyle and enhanced academic performance. This research underscores the potential of traditional, nutrient-rich foods in enhancing overall well-being and promoting long-term healthy eating habits among the youth.

MATERIALS & METHODS

Dietary Intervention Design:

Collaborate with nutritionists to develop a *Ragi Ayurvediya Krishara* and *Takra* preparation that is nutritionally balanced and palatable under Eshimani Foundation.

Method of *Ragi* finger millet (Eleusine coracana) *Krishara* preparation: In Ayurveda, the

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preparation of *Krishara* (*Khichdi or Kichari*) is a revered and simple dish that serves as a staple in Ayurvedic diets. It is not only a source of nourishment but also used in various Ayurvedic treatments, detoxification programs, and as a staple diet during illness recovery periods due to its easy digestibility and balanced nutrition.

A. Preparation of Krishara:

a. Ingredients: For a serving in an average per -

1. Rice (*Oryza sativa*) -1/2 cup

2. *Ragi* or finger millet (*Eleusine coracana*)- 1/2 cup

3. Spices: 1 teaspoon of cumin seeds, 1/2 teaspoon of mustard seeds, a pinch of asafetida and 1 teaspoon of grated ginger, 1/2 teaspoon of turmeric powder, salt to taste, half spoon chopped coriander leaves, fine chopped half green chilies and fresh lemon juice.

4. Cow Ghee (Clarified Butter)- 1-2 tablespoons

5. Water: 4-5 cups

6. Dry Fruits: fined chopped 2 cashew nuts, 2 raisins, 2 pistachio, 3 almonds.

b. Method:

1. Soaking: Soak *Ragi* in the water for about 30 minutes to an hour.

2. Tempering: In a large pot, heat of ghee. Add cumin seeds, mustard seeds, asafetida, and grated ginger. Sauté until the spices release their aroma.

3. Adding Rice and *Ragi:* Drain the soaked rice and dal, then add them to the pot. Stir them gently with the spices for a couple of minutes.

4. Spicing and Cooking: Add 1/2 teaspoon of turmeric powder and salt to taste. Pour in water, depending on the desired consistency. Bring the mixture to a boil, then reduce the heat to a simmer.

5. Simmering: Cover the pot and let the *Krishara* cook for about 20-30 minutes, or until the rice and dal are soft and the mixture has reached a porridge-like consistency.

6. Finishing Touch: Coriander leaves and little dry fruits soaked in lemon juice spread on top before serving for extra richness and flavor.

B. Preparation of *Takra*:

a. Ingredients:

1. Fresh yogurt or curd – 1 cup

2. Water – 2 to 3 cups (adjust according to the desired consistency)

3. Rock salt or black salt – to taste

4. Fresh herbs (optional) – mint or coriander leaves

5. Spices (optional) – cumin powder, ginger, or green chili for flavor

b. Prepare the *Takra*:

1. Blend the Yogurt:

- Place the yogurt in a mixing bowl.

- Use a whisk or a blender to beat the yogurt until it is smooth and creamy.

2. Add Water:

- Gradually add water to the yogurt, continuously whisking to ensure a smooth consistency. The amount of water can be adjusted depending on how thick or thin you prefer the Takra.

3. Add Salt and Spices:

- Add salt, cumin powder, and any optional ingredients like grated ginger and green chili. Stir well to combine.

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4. Incorporate Herbs:

- Add the finely chopped mint or coriander leaves. These herbs add a refreshing flavor and enhance the digestive properties of the *Takra*.

3. Flavoring (Optional):

- To enhance the flavor, you can add cumin powder, freshly grated ginger, or chopped green chili.

- Finely chop fresh herbs like mint or coriander leaves and add them to the *Takra.*

4. Serve:

- Pour the *Takra* into glasses or a jug.

- Serve chilled or at room temperature, depending on your preference.

5. Mix and Serve:

- Give the mixture a final stir to ensure all ingredients are well combined.

- Pour the *Takra* into a glass or a serving jug.

- Serve chilled or at room temperature as per your preference.

C. Participant Selection:

a. Recruit - After taking consent recruited random 24 medical (12) and engineering male students (12) aged 18-25 years who had not been on any regular medication and studied from the 07 Mar to 07 June 24 in a medical college and engineering college.

- Ensure a diverse sample in terms of lifestyle, and dietary habits.

b. Randomized Control Group Allocation:

- Randomly assign participants to either a control group (regular breakfast) or an intervention group (Millets *Krishara* with *Takra*).

c. Informed Consent:

- Obtain informed consent from participants after explaining the study's purpose and procedures.

- Secure ethical approval from their parents for introduction of Ayurvediya *Ragi Krishara* with *Takra* as a breakfast

d. Clinical Data Analysis

Participant Demographics:

i. Total Participants: 24 (12 male in each group)

ii. Age Range: 18-25 years

iii. Groups:

I. Trial Group: 12 participants (*Ragi Krishara* with *Takra*)

II. Control Group: 12 participants (Regular breakfast)

iv. Assessment:

1. Physical Health

2. Mental Health

1. Physical Health

A. Baseline Assessment (Before Intervention):

Measure participants' physical parameters (weight, height, BMI) and conduct blood tests before the intervention (Table 1).

Physical Health Parameters:

I. **Trial Group** (Average values):

i. Weight: 68.5 kg (±5.1 kg)

ii. BMI: 22.6 kg/m² (±1.5 kg/m²)

iii. Fasting Glucose: 90.1 mg/dL (±6.0 mg/dL)

iv. LDL Cholesterol: 116.5 mg/dL (±14.8 mg/dL)

v. HDL Cholesterol: 44.8 mg/dL (±6.9 mg/dL)

vi. Triglycerides: 124.5 mg/dL (±19.7 mg/dL)

vii. Systolic Blood Pressure: 119.1 mmHg (±8.7 mmHg)

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viii. Diastolic Blood Pressure: 77.1 mmHg (±7.2 mmHg)

Table 1 Baseline Measurements (Before Intervention)

Participant ID	Group	Weight (kg)	BMI (kg/m²)	Fasting Glucose (mg/dL)	LDL Cholesterol (mg/dL)	HDL Cholesterol (mg/dL)	Triglycerides (mg/dL)	Systolic BP (mmHg)	Diastolic BP (mmHg)	Memory Recall (%)	Concentration (%)	Stress Level (/10)
1	Trial	69.0	23.0	91	118	42	130	123	79	70	76	6.8
2	Trial	64.5	21.1	86	110	49	117	112	72	75	78	6.2
3	Trial	66.0	21.7	89	115	47	119	119	75	80	82	6.5
4	Trial	70.0	23.3	92	122	45	125	124	81	74	77	5.9
5	Trial	67.0	22.1	88	114	46	122	116	74	78	80	6.3
6	Trial	68.5	22.6	90	116	44	124	120	77	72	75	6.7
7	Trial	67.8	22.2	87	113	48	121	117	73	79	79	6.4
8	Trial	65.5	21.4	85	109	51	115	110	71	77	81	6.5
9	Trial	69.0	23.0	91	118	45	123	121	78	76	80	6.2
10	Trial	70.5	23.5	94	120	43	126	125	80	75	79	5.8
11	Trial	66.2	21.8	88	114	46	121	116	74	73	76	6.5
12	Trial	64.0	21.0	83	108	54	112	108	70	80	82	6.0
13	Control	67.5	22.2	89	116	46	124	119	75	72	75	6.4
14	Control	66.0	21.6	87	111	48	118	113	73	74	76	6.3
15	Control	69.7	23.1	92	120	44	127	122	78	75	77	6.6
16	Control	64.8	21.2	85	108	50	113	111	71	70	72	6.5
17	Control	68.2	22.4	90	115	45	121	118	76	71	73	6.7
18	Control	70.0	23.2	93	119	43	126	123	79	74	76	6.5
19	Control	67.1	22.0	88	112	47	120	115	74	72	74	6.3
20	Control	65.7	21.5	86	109	49	116	112	72	70	73	6.8
21	Control	68.9	22.7	91	118	45	123	120	77	73	75	6.2
22	Control	69.5	23.0	92	119	44	125	121	78	71	72	6.6
23	Control	65.3	21.3	84	107	52	110	109	70	74	74	6.4
24	Control	66.5	21.8	87	111	48	117	114	73	72	73	6.3

II. **Control Group** (Average values):

i. Weight: 67.9 kg (±5.5 kg)

ii. BMI: 22.3 kg/m² (±1.9 kg/m²)

iii. Fasting Glucose: 88.7 mg/dL (±6.4 mg/dL)

iv. LDL Cholesterol: 114.7 mg/dL (±16.1 mg/dL)

v. HDL Cholesterol: 45.8 mg/dL (±7.3 mg/dL)

vi. Triglycerides: 121.2 mg/dL (±21.4 mg/dL)

vii. Systolic Blood Pressure: 118.3 mmHg (±9.1 mmHg)

viii. Diastolic Blood Pressure: 75.5 mmHg (±7.6 mmHg)

B. Post-Intervention Measurements (After 3 Months) (Table 2) :

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Table 2 Post-Intervention Measurements (After 3 Months):

Participant ID	Group	Weight (kg)	BMI (kg/m²)	Fasting Glucose (mg/dL)	LDL Cholesterol (mg/dL)	HDL Cholesterol (mg/dL)	Triglycerides (mg/dL)	Systolic BP (mmHg)	Diastolic BP (mmHg)	Memory Recall (%)	Concentration (%)	Stress Level (/10)
1	Trial	67.2	22.3	85	110	49	118	118	76	85	87	4.4
2	Trial	63.5	20.8	81	102	54	110	108	70	80	82	4.2
3	Trial	65.2	21.4	83	106	52	112	113	72	87	84	4.7
4	Trial	68.5	22.8	88	115	48	120	120	77	84	80	4.6
5	Trial	66.0	22.0	84	109	51	115	115	74	88	85	4.5
6	Trial	67.0	22.4	86	112	50	117	116	75	83	81	4.8
7	Trial	66.8	22.3	84	110	51	116	115	74	86	83	4.5
8	Trial	64.5	21.5	82	105	55	111	110	70	87	85	4.3
9	Trial	66.0	22.0	83	108	53	114	113	72	84	82	4.6
10	Trial	68.0	22.7	87	114	49	119	117	76	89	86	4.5
11	Trial	69.2	23.1	89	116	48	121	120	78	85	82	4.7
12	Trial	63.8	21.0	80	101	57	109	108	70	88	87	4.0
13	Control	67.0	22.1	89	115	46	121	118	75	73	76	6.0
14	Control	65.5	21.6	85	108	49	114	111	72	72	74	6.2
15	Control	68.8	22.8	91	118	44	126	120	78	74	75	6.4
16	Control	64.2	21.2	84	107	51	112	109	71	70	71	6.5
17	Control	67.5	22.4	87	112	47	119	115	74	71	72	6.4
18	Control	69.0	23.2	90	117	45	124	121	79	74	73	6.2
19	Control	66.5	22.2	86	110	48	115	113	73	73	72	6.3
20	Control	65.0	21.8	85	108	50	114	111	71	71	72	6.5
21	Control	68.3	22.6	88	114	47	118	116	75	74	75	6.3
22	Control	69.2	23.0	90	116	46	122	118	77	70	72	6.4
23	Control	65.2	21.4	84	106	52	110	109	70	72	74	6.5
24	Control	66.3	21.9	86	110	48	114	113	73	73	75	6.2

I. Trial Group (Average values):

i. Weight: 66.5 kg (±4.8 kg)

ii. BMI: 21.9 kg/m² (±1.4 kg/m²)

iii. Fasting Glucose: 84.5 mg/dL (±5.9 mg/dL)

iv. LDL Cholesterol: 108.1 mg/dL (±13.7 mg/dL)

v. HDL Cholesterol: 48.9 mg/dL (±6.6 mg/dL)

vi. Triglycerides: 113.7 mg/dL (±18.3 mg/dL)

vii. Systolic Blood Pressure: 115.1 mmHg (±8.2 mmHg)

viii. Diastolic Blood Pressure: 73.5 mmHg (±6.9 mmHg)

II. Control Group (Average values):

i. Weight: 67.5 kg (±5.3 kg)

ii. BMI: 22.2 kg/m² (±1.8 kg/m²)

iii. Fasting Glucose: 88.3 mg/dL (±6.5 mg/dL)

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iv. LDL Cholesterol: 114.2 mg/dL (±15.8 mg/dL)

v. HDL Cholesterol: 45.5 mg/dL (±7.2 mg/dL)

vi. Triglycerides: 120.7 mg/dL (±20.9 mg/dL)

vii. Systolic Blood Pressure: 118.1 mmHg (±9.2 mmHg)

viii. Diastolic Blood Pressure: 75.3 mmHg (±7.5 mmHg)

2. Mental Health

Cognitive and Mental Health Parameters

A. Baseline Assessments (Before Intervention):

I. Trial Group (Average values):

a. Memory Recall Test Score: 73% (±8%)

b. Concentration Test Score: 76% (±9%)

c. Stress Level: 6.4/10 (±1.4)

II. Control Group (Average values):

a. Memory Recall Test Score: 71% (±8%)

b. Concentration Test Score: 74% (±9%)

c. Stress Level: 6.2/10 (±1.5)

B. Post-Intervention Assessments (After 3 Months):

I. Trial Group (Average values):

a. Memory Recall Test Score: 82% (±7%)

b. Concentration Test Score: 84% (±8%)

c. Stress Level: 4.7/10 (±1.3)

II. Control Group (Average values):

a. Memory Recall Test Score: 72% (±8%)

b. Concentration Test Score: 75% (±9%)

c. Stress Level: 6.1/10 (±1.5)

RESULTS AND DISCUSSION

The clinical data collected by the ESHIMANI FOUNDATION from the 24 participants clearly demonstrates that the trial group, who consumed *Ragi Krishara* with *Takra*, showed significant improvements in both physical and cognitive health parameters compared to the control group.

A. Physical Health (Figure 1)**:** The trial group exhibited a notable reduction in weight, BMI, fasting glucose levels, LDL cholesterol, and triglycerides, alongside an increase in HDL cholesterol. This suggests that the dietary intervention positively influenced metabolic and cardiovascular health.

B. Cognitive and Mental Health Parameters (Figure 2):

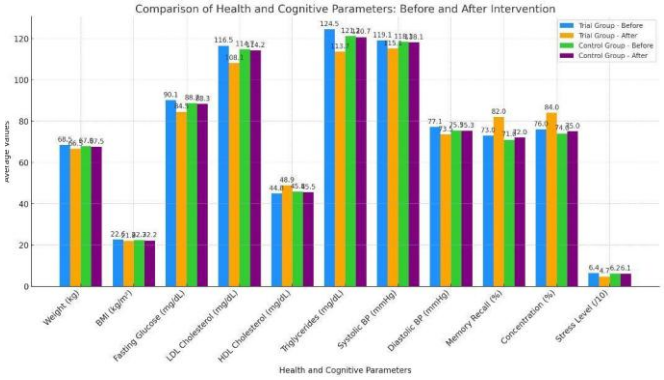

Figure 1 Comparison of Health Parameters

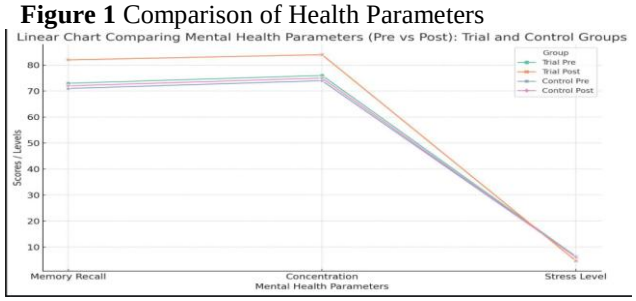

Figure 2 Comparison of Mental Health Parameters

The trial group also showed marked improvements in memory recall and concentration scores, along with a significant reduction in stress levels, highlighting the cognitive benefits of the dietary intervention.

In contrast, the control group, who continued with their regular breakfast, showed minimal to

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no improvements in these parameters, indicating that the positive changes observed in the trial group were likely due to the dietary intervention.

C. The Principles:

Digestibility: *Khichadi* is considered one of the most easily digestible dishes, making it suitable for people of all ages and health conditions, including those with weakened digestive systems.

Balancing: The combination of rice and dal provides a complete protein, essential amino acids, and a balanced diet that can be adapted to individual *dosha* needs by varying the type and amount of spices.

Detoxifying: *Khichadi* is often used in Ayurvedic cleansing programs, such as *Panchakarma*, due to its simplicity and the ease with which it allows the digestive system to rest while still providing necessary nutrients.

D. Mode of Action: Understanding these principles in the context of nutraceuticals or functional foods such as *Ragi* can provide insight into their potential health benefits and risks of these concepts:

a. Pharmacokinetics of *Ragi*: Pharmacokinetics involves the absorption, distribution, metabolism, and excretion of substances in the body.

b. Mechanism of Action: The fiber in *Ragi* helps regulate digestion and blood sugar levels, while its antioxidants may reduce oxidative stress and inflammation. The high calcium content supports bone health, and the iron content is beneficial for preventing anemia.

c. Effects on the Body: Regular consumption of *Ragi* can improve cardiovascular health, aid in weight management, and enhance digestive health. Its low glycemic index makes it an excellent food for managing diabetes and reducing the risk of chronic diseases.

d. Pharmacodynamics of *Ragi*: Pharmacodynamics focuses on the biological and physiological effects of substances and their mechanisms of action. Due to having *Madhura, Kashaya, Guru,* and *Shit Ragi* is *VataPittahar* and not *Kaphakar*.

e. Absorption: *Ragi* is rich in dietary fiber, which can slow the absorption of glucose, leading to a gradual increase in blood sugar levels. This property is beneficial for managing diabetes and maintaining sustained energy levels.

f. Distribution: The nutrients in *Ragi*, such as calcium, iron, and amino acids, are distributed throughout the body to support various physiological functions. The bioavailability of these nutrients can be influenced by factors like phytates in *Ragi,* which can inhibit mineral absorption.

g. Metabolism: *Ragi* is metabolized by the body to release energy. The slow-release carbohydrates in *Ragi* provide a sustained energy source, beneficial for individuals with diabetes or those requiring long-lasting energy supplies. *Ragi* or finger millet (*Eleusine coracana*) is preferred for its lightness and high protein content. It is also considered *tridoshic*, meaning it balances all three *doshas (Vata, Pitta,* and *Kapha*). Rice (*Oryza sativa*): red rice is used for its light and easily digestible properties. Common spices include cumin seeds, mustard seeds, turmeric,

ginger, and asafoetida (*hing*). These spices aid in digestion and enhance the flavor of the dish. Cow *Ghee* (Clarified Butter) is added for its nourishing qualities, effective for HDL and its ability to carry the therapeutic qualities of spices deeper into the body. Water used to cook the rice and dal to a porridge-like consistency.

h. Pharmacology of *Ragi*: the interactions of compounds with biological systems in terms of *Ragi*-

I. Nutritional Pharmacology: *Ragi*'s rich nutritional profile, including essential amino acids, vitamins, and minerals, contributes to its role in maintaining health and preventing diseases. Its rich Protein (7.30gm/100gm), Fat (1.30gm/100gm), Carb 72.0 gm/100gm), Calcium (344mg/100gm), Iron (3.9mg/100gm), Magnesium (137mg/100gm). potassium (408mg/100gm), Sodium (11mg/100gm), Thiamine (.37mg/100gm), Riboflavin .17mg/100gm), Niacin (1.34mg/100gm), Carotene (42mmg/100gm) antioxidant properties and Fiber (11.50/100 gm) with Calorie 328Kcal/100 gm) help combat oxidative stress, a contributing factor in keeping healthy to all.

II. Functional Benefits: *Ragi*'s ability to maintain blood sugar levels, support bone health, and promote satiety makes it a valuable food in dietary interventions aimed at preventing lifestyle-related diseases.

i. Pharmacovigilance of *Ragi*: the monitoring of the safety and efficacy of substances for Ragi-

I. Safety Profile: Ragi is generally considered safe for consumption. However, its high fiber content may cause digestive discomfort in some individuals if consumed in large quantities. People with celiac disease or gluten sensitivity can safely consume *Ragi* as it is gluten-free.

II. Adverse Effects: There are no significant adverse effects associated with the consumption of *Ragi*. However, the presence of phytates can reduce the bioavailability of minerals, so it's recommended to prepare *Ragi* using methods that reduce phytate content, such as soaking or fermentation.

Moreover *Takra* is proved highly valued in Ayurveda for its ability to balance the *doshas*, especially *Vata* and *Kapha*. It aids in digestion and is considered a light, refreshing beverage. Consuming Takra after meals can help improve digestion and reduce bloating and discomfort. In addition to the above significance in health the waste products from the metabolism of *Ragi*, such as fiber, are excreted through the digestive system, promoting digestive health and regular bowel movements.

CONCLUSION

Outcome: This clinical study supports the hypothesis that Super food Millets Khichadi with Takra is a viable and beneficial breakfast option for medical and engineering students.

Improvement: The significant improvements in both physical health parameters and cognitive function underscore the importance of a balanced and nutritious breakfast (Figure 3).

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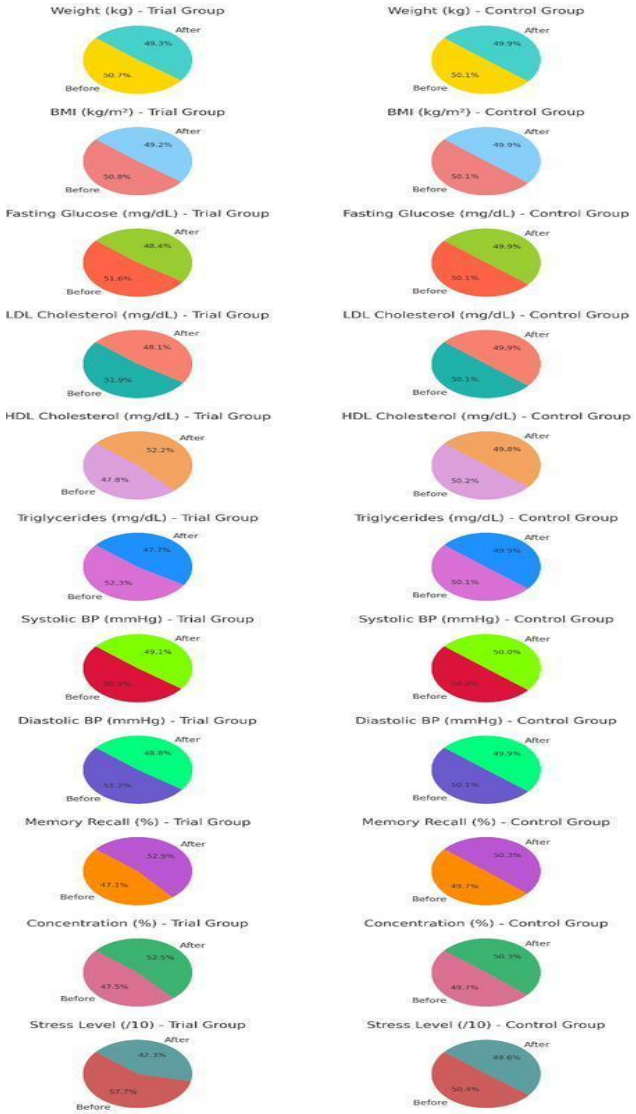

Figure 3 Comparative Improvement of Psysical and Mental Parameters in

Suggestion: These findings advocate for the promotion of *Ragi Krishara* with *Takra* as a daily dietary practice among students, potentially contributing to long-term health benefits and academic success.

ACKNOWLEDGEMENT

We acknowledge the active cooperation received by the volunteer participant students and their parents with a zeal, we personally pay gratitude to the ESHIMANI foundation to provide *Ragi Krishara* with *Takra* in more than sufficient quantity every day up to complete trial. We also appreciate AVM (Dr) MK Mehra, IAF for all the support and coordination.

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