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ASSESSMENT OF NUTRITIONAL POTENTIAL OF INDIGENOUSLY MADE SPROUTED GRAM BISCUITS: A POTENTIAL USE IN PREGNANT PATIENTS.

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Abstract
Protein deficiency during pregnancy can hinder foetal development and increase the risk of complications. Adequate protein intake is crucial for the formation of vital tissues and organs in the developing baby. The prevalent consumption of conventional biscuits, laden with refined flour, sugar, and unhealthy fats, has led to a surge in global health concerns. Sedentary lifestyles, coupled with the ubiquity of such snacks, contribute to weight gain, elevated cholesterol, and heightened risks of chronic diseases. Addressing this, there is a growing demand for healthier options without compromising taste or convenience. This study introduces sprouted gram biscuits as an innovative and nutritious alternative. The sprouting process enhances the biscuits' nutritional profile by augmenting the accessibility of vital nutrients and breaking down anti-nutrients for improved digestion. The recipe incorporates sprouted green gram, whole Bengal gram, cowpea, and green peas in a specific combination, resulting in a high-protein, low-carbohydrate, and high-fiber composition. The nutritional analysis reveals substantial protein content (58.01%), significant fiber (9.84%), and minimal fat (5.5%). With an energy value of 361.18 Kcal per 100 grams, the biscuits also boast notable levels of calcium and vitamin B12. Sensory evaluation by 10 panelists confirms satisfaction in color, taste, texture, shape, and crunchiness, with ratings not exceeding three on a Hedonic scale of nine. In conclusion, this study underscores the potential of sprouted gram biscuits as a healthful snack alternative. The combination of sprouted gram from four pulses in a wheat flour base yields a nutrient-packed biscuit with high fiber, protein, and essential vitamins and minerals. With reduced carbohydrates, these biscuits offer a healthier choice without compromising on flavour, making them suitable for those seeking a balance of taste and nutrition especially during antenatal period.
Keywords: biscuit healthy, grams, sprouted, fibre

Introduction:
The omnipresent biscuit has become a fixture in the everyday routines of numerous individuals in a world where convenience often surpasses nutritious content. These tasty delights, however, frequently come with a hidden cost - an increasing number of

biscuit lovers are dealing with health issues related to the daily intake of commercially made biscuits[1].
Regular biscuits, which are high in refined flour, sugar, and harmful fats, have prompted concerns among health-conscious consumers. The rising prevalence of sedentary lifestyles, along with the pervasiveness of these food choices, has resulted in an increasing percentage of people experiencing weight gain, elevated cholesterol levels, and an increased risk of chronic diseases.[2]. As the negative effects of traditional biscuits become increasingly evident, there is an urgent demand for a healthy option that does not sacrifice flavour or convenience.
Sprouted grains, which are produced from legumes, go through a germination process that improves their nutritional profile. This process not only makes vital nutrients more available, but it also breaks down anti-nutrients, making them more digestible. [3]. As a result, the biscuit not only tastes good but also meets the nutritional demands of the body. In this study, we have attempted to make sprouted gram biscuit with analysis of its antioxidant potential, vitamins, and minerals.

Methods:
One hundred grams each of 1. green gram 2. whole Bengal gram 3. cow pea 4. green peas were taken and soaked in plain water for 12 hours. The suggested combination is not described while it's from the authors personal experience in nutrition for more than two decades. (See figure1)

Fig 1 showing soaked pulses.

The water is drained and dried. They were kept to allow sprouting.
The next steps were.
Roast lightly and dry it in the shade
Powder it and sieve it to a fine powder
Knead the butter and the baking powder till frothy appearance
Add 1 cup of sprouted gram powder to half cup of wheat flour (Base) and a 1 cup of powdered sugar, pinch of salt
Two teaspoons of milk were added
Knead it to a dough
Press between palms to different shapes
Preheating the oven for 30 minutes at 120 degrees
Place the desired shaped dough in the oven for around 15 minutes
The sprouted gram biscuit is ready (Figure 2)

Crude fiber content is determined by following the method of Sadasivam and Manikam (1992). Protein estimated by the method of Sadasivam and Manikam (1997). Total fat and ash content of sample is determined by the method of Ranganna (1986). Calculation of the total crude carbohydrate content of the sample using the formula (Janardhanan and Lakshmanan, 1985). The energy value of the sample is determined by AOAC (1990) method. The HPLC method was used to detect vitamins. [4-8]

A total of 10 panellists were selected to assess the different aspects of biscuit including colour, taste, texture, shape, and crunchiness. They were advised to score with a system with a 9 point Hedonic scale. [9]
9 - Dislike extremely
8 - Dislike very much
7 - Dislike moderately
6 - Dislike slightly
5 - Neither like nor dislike
4 - Like slightly
3 - Like moderately
2 - Like very much
1 - Like extremely
The panellists were followed for seven days with no adverse effects.

Results:
The protein, carbohydrate and fibre content are tabled below. (Table 1). The presence of high fibre was the hallmark of the biscuit.

Table 1 showing the primary metabolites and fibre content

S, no.	Analyses	Result
1	Fibre (%)	9.84
2	Protein (%)	58.01
3	Fat (%)	5.5
4	Total Ash (%)	1.74
5	Carbohydrate (%)	19.91
6	Energy (Kcal /100gram)	361.18

The various vitamins and mineral levels are tabled below (see table 2) .Even though the amount is less, the presence of calcium and vitamin B12 looks significant.

Table 2 showing the content of minerals and vitamins in the sprouted gram biscuit:

S.No.	Substance	Level
1	Iron	<0.01 µg/dL
2	Calcium	6.6 mg/dl
3	Phosphorous	0.7 mg/dl
4	Vitamin B 12	83 pg/dl
5	Vitamin D	0.01ng/dl

All the ten panellists were very much satisfied with all the five qualities of the biscuit and no score was above three.

Table 3 showing ten panellists and their scores on different sensory applications of the biscuit.

panellist	colour	taste,	texture	shape	crunchiness
1	1	2	2	1	1
2	2	2	1	2	1
3	1	2	2	2	1
4	2	1	1	2	1
5	2	3	2	2	1
6	1	2	1	1	1
7	3	2	3	1	1
8	3	2	3	1	1
9	2	2	3	2	1
10	1	2	2	2	1

Discussion:

Various researches have focused on the nutritional content and potential health effects of the common spouted gram biscuits. Sprouted gram biscuits are frequently complimented for their high protein content. The sprouting process is thought to improve the nutritional profile by improving nutrient availability. Sprouting breaks down molecules that limit nutrient absorption, potentially making the end-product more nutrient-dense than non-sprouted alternatives.[10] Another focus of these studies is micronutrient content. Our biscuit had very high protein content and this is likely when sprouting of grams are performed. Our ash content was on the higher side due to a routine home-made approach. This can be negated with a more professional approach with high volumes. The calorific value is also less with minimal carbohydrates which makes this biscuit suggestible for diabetic patients. We had higher levels of calcium and vitamin B12. The levels of vitamins and minerals in sprouted gram biscuits vary based on the recipe and ingredients. [11]Our biscuit was essentially made of four types of grams and essentially without Maida flour which makes it more nutrient rich and healthy. The Maida as an ingredient makes it tasty with adverse effects on obesity and insulin resistance. The role of biscuits and soups and snacks especially fortified with vitamins have played a great role in tackling dietary management of sick patients. [12,13] The flour to be used is different in many studies but we used wheat flour as gram flours are needed as a base. [14]Wheat flour is ideal to knead and make it ideal of oven heating according to our experience. . Our study is very preliminary to categorically conclude that such combination of four grams is ideal for sprouted gram biscuits. Agarkar et al [15] have found that the texture and appearance of sprouted gram biscuits are higher than the control biscuits which is confirmed by our studies with the score never exceeding 3 in any of the sensory evaluation scores. We accept that a few statements in the study is more based on experience than evidence. Gernard et al [16]have stated that nutrition deficiency including proteins and fibres is very prevalent in pregnant women, the problem being global. Hence such biscuits can be of help as snacks and achieve better health in the antenatal population.

Conclusion:

The combination of sprouted gram from the four pulses, green gram, whole Bengal gram, cow pea, green peas in a wheat flour base to make nutrient biscuits is feasible. The high fibre and the protein content with less carbohydrates makes it a healthy alternative especially in antenatal mothers.

Conflict of interest – Nil
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Ethical issues – Nil

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