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Original Article

Estimation of Crude Fibre Content from Natural Food Stuffs and its Laxative Activity Induced in Rats

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ABSTRACT

Crude fiber consists largely of cellulose(60-80%) and lignin (4-6%) plus some mineral matter. These Fibers are beneficial in treating or preventing constipation, hemorrhoids, diverticulosis, coronary heart diseases, and some type of cancer. A rapid method was developed for the quntative estimation of crude fiber present in nine different natural food stuff by using Hennerberg, Stohmann and Rauterberg method. The following plants Triticum aestivum, Zingiber officinale Roscoe, Pisum sativu, Trigonella foenum-graecum, Cicer arietinum, Brassica nigra, Arachis hypogaea, Cocos nucifera, Coriandrum sativum, Psidium guajava, Musa acuminate, Vitis vinifera, Citrullus lanatus, Carica papaya shows the ascending order of crude fiber percentage. The laxative activity of fruits (guava, banana, grapes, water melon) was studied in rats. The results showed that an oral administration of the fruit pulp extract produced significant and crude fibre dependant increase in faeces output of rats.

Key words: Crude fiber, Hennerberg, Stohmann and Rauterberg method, laxative activity.

1. INTRODUCTION [1]

Over the last decade, significant developments have been made in our understanding of crude fiber and its role in the promotion of health and disease risk reduction. A wealth of scientific evidence demonstrates that adequate dietary fiber intake has a number of health benefits, including maintenance of healthy laxation and the reduced risk of cardiovascular disease and cancer. The 2005 *Dietary Guidelines for Americans* recommendation to "choose fiber-

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rich fruits, vegetables, and whole grains often" is based on this evidence [2]. Other potential health benefits being investigated include fiber's role in maintaining a healthy weight [3,4,5], gastrointestinal health [6,7,8], and in treating or preventing constipation [9,10], hemorrhoids [11,12], coronary heart diseases[13,14,15], and some type of cancer [16,17,18], and glucose modulation [19,20,21.]

Crude fiber rcommendations and Intake [22]

In 2002, the Institute of Medicine (IOM) established an Adequate Intake (AI) level for fiber as part of the Dietary Reference Intake (DRIs) for macronutrients. The IOM recommends that people of all ages consume 14 grams of fiber for each 1,000 calories. Please see Table 1 for recommendations by age and sex.

Table 1: Fiber Recommendations by Age and Sex [2]

Population	Daily Fiber Recommendation
Children ages 1-3 years old	19 grams
Children ages 4-8 years old	25 grams
Young boys ages 9-13 years old	31 grams
Young girls ages 9-13 years old	26 grams
Teenage boys ages 14-18 years old	38 grams
Teenage girls ages 14-18 years old	26 grams
Young and adult men ages 14-50 years old	38 grams
Young and adult women ages 19-50 years old	25 grams
Men ages 50 years and older	30 grams
Women ages 50 years and older	21 grams

2. EXPERIMENTAL PROCEDURE FOR CRUDE FIBRE ESTIMATION:[23,24]

Principle:

Hennerberg, Stohmann and Rauterberg method: During the acid and subsequent alkali treatment, oxidative hydrolytic degradation of the native cellulose and considerable degradation of lignin occur. The residue obtained after final filteration is weighed, incinerated, cooled and weighed again. The loss in weight gives the crude fiber content.

Essential instruments: Muffle furness , desiccator, homogenizer, water bath, heating mantle, centrifuge, weighing balance etc.

Chemicals and reagents: Sulphuric acid solution. Sodium hydroxide solution, petroleum ether, water and alcohol(ethanol).

Preparationofsolutions:

Sulphuric acid solution (0.255 ±0.005N) :

1.25g concentrated sulphuric acid diluted to 100mL (concentration must be checked by titration)

Sodium hydroxide solution (0.313 ±0.005N0 :

1.25g sodium hydroxide in 100mL disyilled water (concentration must be checed by titration with standard acid)

Sample preparation:

The plant material were collected in the month of August 2016 from a local market. Around 500gms of plant material was collected. The plant material was taxonomically identified by Dr. S.K Mahmood, Department of Botany, Nijam University- Hyderabad.

The plant materials were powdered with a mechanical grinder to form a coarse powder. The powder was passed through sieve no 40 and was stored in an air tight container until further use. The powder was used for the extraction process.

Procedure:

1. Extract 2g of ground material with ether or petroleum ether to remove fat (Initial boiling temperature 35 - 38°C and final temperature 52°C). if fat content is below 1%, extraction may be omitted.
2. After extraction with ether boil 2g of dried material with 200mL of sulphuric acid for 30min with bumping chips.
3. Filter through muslin and wash with boiling water until washing are no longer acidic.
4. Boil with 200mL of sodium hydroxide solution for 30min.
5. Filter through muslin cloth again and wash with 25mL of boiling 1.25% H_2SO_4, three 50mL portions of water and 25mL alcohol.
6. Remove the residue and transfer to ashing dish (preweighed dish W_1).
7. Dry the residue for 2h at 130 ±2°C. Cool the dish in a desiccator and weigh (W_2).
8. Ignite for 30min at 600 ±15°C.
9. Cool in a desiccator and reweigh (W_3).

Calculation:

$$\text{\% crude fiber in ground sample} = \frac{\text{Loss in weight on ignition } (W_2 - W_1) - (W_3 - W_1)}{\text{Weight of the sample}} \times 10$$

EXPERIMENTAL PROCEDURE FOR LAXATIVE ACTIVITY ESTIMATION:[25,26]

Sample preparation:

The extract of fruits pulp of guava, banana, grapes, water melon was prepared homogenizing the pulp and dried under shade and thus mass obtained was powdered,

weighed and subjected to the evaluation for its laxative potential. The yield of dark pasty like mass was diluted by adding 10ml of saline to give a fluid like consistency for better oral administration through needle.

Animals

Albinos Wistar rats weighing 150-200 g were housed and bred in the animal house. The animals were kept in standard

cages with good ventilation, free access to feeds and water. Experimental procedures and protocols used in this study were approved by ethical committee. These guidelines were in accordance with the internationally accepted principles for laboratory use and care.

Laxative activity: [24]

The method of Capasso *et al.* [25] was followed for this activity. Rats fasted for 12 h before the experiment were placed individually in cages lined with clean filter paper.

Rats were divided in six groups and the dose was given orally.

1st group: Acting as the control and administered normal saline (1 mL/rat/hour).

2nd group:Acting as the standard and administered castor oil (1 mL/rat/hour).

3rd group: Received guava solution (1 mL/rat/hour).

4th group: recieved banana solution (1 mL/rat/hour).

5th group: received grapes solution (1 mL/rat/hour).

6th group: received water melon solution (1 mL/rat/hour).

The same amount of dose solutions was given to each groups for 5 hours respectively.

The faeces produced in all six groups was monitored for 16 h.

3. RESULTS AND DISCUSSION

Table 2: Data showing the amount crude fibre present in some plant materials

S.NO	PLANT MATERIALS	WEIGHT TAKEN (in gms)	W_1 (in gms)	W_2 (in gms)	W_3 (in gms)	CRUDE FIBRE %
1	Pea nut (**Arachis hypogaea)**	2.5±0.01	0.580±0.001	0.2824±0.003	0.0054±0.001	47.75
2	Coconuts (**Cocos nucifera)**	2.5±0.01	2.04±0.002	1.0377±0.001	0.0196±0.003	49.90
3	Chickpea (**Cicer arietinum)**	2.5±0.01	1.910±0.003	0.445±0.003	0.0056±0.002	23.52
4	Black mustard (**Brassica nigra**)	2.5±0.01	2.320±0.002	0.8815±0.002	0.0067±0.001	37.70
5	Fenugreek (**Trigonella foenum-graecum)**	2.5±0.01	1.70±0.001	0.3502±0.003	0.0070±0.003	20.18
6	Wheat (**Triticum aestivum)**	2.5±0.01	0.91±0.003	0.0531±0.001	0.0015±0.003	5.67
7	Coriander (**Coriandrum sativum)**	2.5±0.01	1.82±0.001	1.1694±0.001	0.0263±0.001	62.80
8	Green pea (**Pisum sativum)**	2.5±0.01	1.93±0.003	0.3125±0.002	0.0069±0.002	15.83
9	Ginger (Zingiber officinale Roscoe)	2.5±0.01	3.121±0.002	0.3255±0.001	0.0172±0.001	9.87
10	Papaya (**Carica papaya)**	10±0.01	4.8±0.01	0.1±0.03	0.097±0.02	0.03
11	Water melon (**Citrullus lanatus)**	10±0.03	2.1±0.21	0.1±0.01	0.033±0.03	0.67
12	Banana (Musa acuminata)	10±0.01	2.4±0.01	0.2±0.00	0.044±0.01	1.56
13	Guava (**Psidium guajava)**	10±0.02	5.1±0.00	0.7±0.00	0.482±0.00	2.18
14	Black Grapes (**Vitis vinifera)**	10±0.00	1.4±0.01	0.3±0.02	0.193±0.01	1.07

Mean(n)=3

Where $\mathbf{W_1}$ = weights of residue before drying,

$\mathbf{W_2}$ = weight of residue after drying for 2hrs at 130 ±2°C,

$\mathbf{W_3}$ = weight of residue after ignite for 30min at 600 ±15°C.

Table.3: Data showing the weight of feaces output from each group and each rat.

Group no	Treatment	Wt. of faeces output from each group (X in gms)	Wt. of feacal matter output from each rat (X/6)in gms
1.	Saline (control)	2.6±*0.42*	0.43±*0.56*
2.	Castor oil (std)	12.1±*0.59*	2.01±*0.88*
3.	Guava	10.2±*0.11*	1.7±*0.37*
4.	Banana	7.5±*0.92*	1.25±*1.12*
5.	Watermelon	3.2±*0. 36*	0.5±*0.69*
6.	Grapes	4.9±*1.02*	0.81±*0.93*

Number of rats per group(n)= 6

Table 4: Data showing the amount of laxative activity induced on each rat based on the fruit extract given orally

Group no	Treatment	Laxative activity induced on each rat
1	Castor oil (std)	3.67
2	Guava	2.95
3	Banana	1.90
4	Watermelon	0.23
5	Grapes	0.88

4. CONCLUSION

From the above values of crude fibre percentage in different natural plant materials it is found that different plant material contains varying amounts of crude fiber. So according to IOM people of different ages and sex should intake prescribed amount of crude fiber daily for the respective food stuff comsumed.

The laxative activity of fruits (***guava, banana, grapes, water melon***) was studied in rats. The results showed that an oral administration of the fruit pulp extract produced significant and crude fibre dependant increase in faeces output of rats.

A wealth of scientific evidence demonstrates that adequate crude fiber intake has a number of health benefits, including maintenance of healthy laxation and the reduced risk of cardiovascular disease and cancer etc.

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