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The Role of Chapati (Wheat Roti) as a dietary cause for Fissure-in-Ano among Wheat Roti Consuming Population – A Retrospective Cohort Study

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Abstract:

Improper *ahara-vihara* is the cause for all diseases. This is well established fact that among ahara related etiology, *godhooma* (wheat) is said to be heavy for digestion and passage of hard constipated stools results tear in the lower anal canal which includes pain during and after defecation. A gluten protein is found in wheat, causes an inflammatory reaction that leads to flattening of the lining of the small intestine, interfere with the absorption of nutrients. The wheat roti will eventually become the risk factor for fissure-in-ano. *Parikartika* occur due to pitta and vata, which, after vitiation, get accumulated in the guda. Intake of aharas which are water absorbent leads to constipation. *Apana vata* gets aggravated in its own seat (*Pakwashaya*) blocking the *srotas*, drying them producing obstruction to the movement of feces, flatus and urine. Some patients said intake of more vegetables, fruits & drinking adequate number of fluids get relieved their problems. Hence a retrospective study was planned and conducted through evidence based structured questionnaires to rule out the consumption of wheat roti as one of the dietary cause for fissure-in-ano and were also treated for chronic anal fissure at KLE's BMK Ayurveda Hospital, Belagavi. A total of 200 patients were studied and data analysed. Descriptive statistics were used to describe demographic and clinical characteristics in the study. Parikartika is very common among ano-rectal diseases due to improper ahara-vihara. The health of an individual depends solely on his diet and lifestyle. This would bring the awareness in the society about the common complications like distension of abdomen, constipation and fissure-in-ano by the consumption of wheat Roti.

Keywords: Fissure-in-ano, Godhooma, Wheat Roti, Parikartika, Retrospective study

Introduction:

Ayurveda has great potential in the field of Preventive medicine and glorifies the concept of *Aahara* (food). *Godhooma* (wheat) is a cereal using since ancient period, botanically identified as Triticum sativum Lin. belonging to Poaceae family. *Chapati* is an absolute part of Indian diet. *Chapatis* were made using soft dough comprising wheat flour, salt and water. Chapathi when made with whole wheat flour is said to be healthy as per the Ayurveda as well as contemporary nutritional science. The wheat on the market today is a new breed and totally lacking its inherent qualities. This difference is as a result of intense crossbreeding programs, which have turned the crop into something that is neither physically nor genetically like its old self. Wheat flour is the flour of choice for the present generation and the finished product is superior in presentation, texture and taste.

Wheat (*godhooma*) eventually produces the *admaana*[4, 24-33]. *Godhooma* is having *madhura rasa; guru, snigdha, sheeta guna; sheeta virya; madhura vipaka; vata-pittahara and kapha-vardhaka*[17-20, 24-31,33]. *Godhooma* is mainly *sandhanakara, sthairyakara, balya, jeevana, brumhana, ruchiprada, shukraprada, varnya, veerya-vardhana, saraka, alparechi karma*[24-27, 29, 32]. *Godhooma* is used mainly in treatment of diseases like *asthi-bhagna, shoola, kasa, hrudroga, prameha, kushta, vatarakta & vrana*[38]. A protein called 'gluten' is found in wheat and when it gets exposure to 'Gliadin', the enzyme tissue trans-glutaminase

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modifies the protein and the immune system cross-reacts with the bowel tissue, causing an inflammatory reaction. This leads to flattening of the lining of the small intestine, which interferes with the absorption of nutrients. The only effective treatment is gluten-free diet[5,6,7]. By nature, wheat contains some extremely powerful opioid peptides[8]. Wheat-opioid peptides can anaesthetise the bowels so much that constipation is caused[9]. Some damaged opioid peptides are extremely hard to decompose by enzymes[10]. With these characteristics the wheat roti will eventually become the risk factors for fissure-in-ano. Wheat produces constipation and makes the person to strain more to evacuate little stool[1]. It is well established fact that the wheat is heavy for digestion[2]. Excessive intake of wheat would produce dryness by absorbing the water content from food stuff, creates dehydration, constipation and distension of abdomen.

Chapathi also known as *roti* and *phulka*[52] is is an staple diet of India originating from the Indian sub-continent and staple in India, Nepal, Bangladesh, Pakistan[53]. *Chapathis* were made of whole-wheat flour known as *atta*, mixed into dough with water, oil and optional salt in a mixing utensil called a *parat* and are cooked on a *tava* (flat skillet)[54,55]. Chapathi is the main filling ingredient in food (breakfast, lunch and dinner), which is a low fibre diet. Excessive intake of wheat roti would be the primary cause for constipation and further the chronic constipation will create a fissure-in-ano.

It is estimated that anal fissure is five times more likely to develop with chronic constipation[11, 12]. Traditionally, the etiology is believed to be trauma for the anal mucosa by the passage of hard stool due to constipation and onset of symptoms follows diarrhoea**.** Chronic anal fissures generally have increased resting anal pressures caused by hyper-tonicity of the internal anal-sphincter, but the causative mechanisms are unclear. Elevated anal pressure also exacerbates the ischemic state of the posterior commissure and the sphincter and reduces ano-dermal blood flow. In general, persons with low dietary fiber intake, sedentary lifestyle, post-partum women and significant stress or anxiety are in risk factors[13].

Trauma and sudden tear of the anal mucosa during evacuation of hard stool is usually an initiating event, but spasm of the internal anal sphincter leading to relative ischemia is thought to be the perpetuating factor[6]. It is estimated that anal fissure is five times more likely to develop with chronic constipation[7,8] An anal fissure (fissure-in-ano) is a longitudinal split in the anoderm of the distal anal canal which extends from the anal verge proximally towards, but not beyond, the dentate line[65]. Acute anal fissures arise from the trauma caused by the strained evacuation of a hard stool or less commonly, from the repeated passage of diarrhoea.

In *parikartika*, *vata* is the dominant *dosha*. *Parikartika* is treated as a complication of *samshodhana chikitsa* and certain diseases. Parikartika is characterized by *kartanwat* and *chedanadvat shool* in *guda* (anus), but the sentinel tag like features is not in the reference of *parikartika*. Sentinel tag can be compared with *shuskarsha* as mentioned by *Charak Samhita.* With these characteristics, the wheat roti will eventually become the risk factors for fissure-in-ano. It is essential to rule out the prevalence of fissure-in- ano cases in wheat roti consuming population at our practicing society. It has to be assessed with proper statistical data and analysis to provide scientific evidence of risk factor (wheat roti) to fissure-in-ano (target population) subjects. So, keeping this objective in the mind, retrospective study was planned to assess the role of *chapathi* consumption and in causing fissure-in-ano.

Aim:

- Identifying the consumption of *wheat roti* as one of the dietary cause for constipation and fissure-in-ano

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Objectives:

- To determine the incidence and prevalence of fissure-in-ano cases among *wheat roti* consuming population
- To develop a reliable screening method with Evidence Based Questionnaire for constipation and Fissure-in-ano

Materials & Methods:

Materials: *Godhooma*[44] ie, Triticum sativum

Rasapanchaka of *Godhooma* (Wheat)	
Rasa	*Madhura*
Guna	*Guru, Snigdha, Sheeta*
Veerya	*Sheeta*
Vipaka	*Madhura*
Karma	*Vata-pittahara & Kaphavardhaka*

Methods:

I. Source of data:

Clinically diagnosed fissure in ano cases attending the *Shalyatantra* OPD at KLE's BMKAyurveda Hospital Shahapur, Belagavi were selected and enrolled after obtaining the well-informed consent.

II. Study design:

The study is a retrospective study that included 200 patients treated for chronic anal fissure.

Inclusion criteria:

1. Patients with lakshana of *malabaddhata* and *parikartika*
2. Pain in anal region during and after defecation
3. Burning sensation
4. Both acute and chronic fissure in ano
5. Presence of sphincter spasm and with a longitudinal ulcer in the anal region were selected
6. Either sex between 20-60 years of age

III. Exclusion Criteria:

1. Patients associated with piles and fistula in ano
2. Known subjects of systemic disorders like bronchial asthma, cardiac diseases, renal failure, diabetes mellitus, irritable bowel syndrome, colitis and hypertension etc.
3. Infectious and immuno-compromised conditions
4. Patients on NSAID, Steroids, constipation causing drugs and substance abuse

Assessment Criteria:

1. Constipation: Functional Constipation[11]: Must include *two or more* of the following:

1.1. Straining during at least 25% of defecations
1.2. Lumpy or hard stools in at least 25% of defecations
1.3. Sensation of incomplete evacuation for at least 25% of defecations
1.4. Sensation of ano-rectal obstruction/blockage for at least 25% of defecations
1.5. Manual maneuvers to facilitate at least 25% of defecations (e.g., digital evacuation, support of the pelvic floor)
1.6. Fewer than three defecations per week

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2. Fissure in ano: Must include *two or more* of the following:

1.1. Pain and burning sensation during & after defecation
1.2. Prolonged pain after defecation for 3-4 hrs
1.3. Streak of blood to the stool
1.4. Hypertonic sphincter ischemic
1.5. Ischemic state of mucosa
1.6. Tenderful Ani

IV. Screening method: Tools for assessment

1. Questionnaire was prepared and a trained assessor were interrogated the patient.
2. Evidence based questionnaire format for content analysis with the evidence of specific causes [A-F] are structured.
3. Expert opinion and pilot study was conducted to make the questionnaire more evident.

Observations & Results:

A total of 200 patients were studied and data analysed. Descriptive statistics were used to describe demographic and clinical characteristics in the study. Characteristics of the study population were presented here.

Table: 1 Gender wise distribution of the patients

Male	Female
152	48

Table: 2 Age distributions of the patient

20 yrs - 30 yrs	17 (8.5%)
31 yrs - 40 yrs	63 (31.5%)
41 yrs - 50 yrs	87 (43.5%)
51 yrs - 60 yrs	33 (16.5%)

Table: 3 Religion wise distributions of the patients

Hindu	112 (56%)
Muslim	88 (44%)
Christian	0 (0%)
Others	0 (0%)

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Table: 4 BMI Distribution of the patients

< 18.5 kg/mtr^2	22
18.5 - 22.5 kg/mtr^2	53
23 - 25 kg/mtr^2	65
26 - 30 kg/mtr^2	32
30.5 - 34.5 kg/mtr^2	20
> 35 kg/mtr^2	8

Table: 5 Type of diet of the patients

Vegetarian	112(56%)
Mixed diet	88(44%)

Low fiber diet can predispose to formation of hard stools hence fissure. Intake of spicy food like hot chili, pepper etc. can aggravate symptoms in patients with acute fissure in ano. Anal fissures occur due to inappropriate diet and a diet modification can reduce the incidence of the disease.

Table: 6 Dominance of ahara rasa in the diet of patients

Madhura rasa	63(31.5%)
Amla rasa	21(10.5%)
Lavana rasa	27(13.5%)
Katu rasa	89(44.5%)
Tikta rasa	0(0%)
Kashaya rasa	0(0%)

Table:7 Dominance of guna in diet

Guru guna ahara sevana	38(19%)
Laghu guna ahara sevana	26(13%)
Sheeta guna ahara sevana	19(9.5%)
Ushna guna ahara sevana	24(12%)
Snigdha guna ahara sevana	17(8.5%)

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Ruksha guna ahara sevana	76(38%)

Table: 8 Dietary habits of the patients

Samashana habit	67(33.5%)
Adhyashana habit	76(38%)
Vishamashana habit	57(28.5%)

Table: 9 Appetite described by the patients

Poor appetite	121(60.5%)
Moderate appetite	33(16.5%)
Good appetite	46(23%)

Table: 10

Yes	72(36%)
No	128(64%)

Table: 11 Activity level of the patients

Active	Moderate	Sedentary
49(24.5%)	78(39%)	73(36.5%)

Table: 12 Type of deha Prakriti of the patients

Vata-pitta	Vata-kapha	Pitta-kapha
74(37%)	89(44.5%)	37(18.5%)

Table: 13 Consumption Frequency of Chapati/day

Almost every day	23(11.5%)
Sometimes	24(12%)
Often	22(11%)
Seldom	12(6%)

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None	0(0%)

Table: 14 Where chapati eaten

Home	138(69%)
Café	28(14%)
Work place	18(9%)
Other	16(8%)

Table: 15 Eating chapathi with

Breakfast	68(34%)
Lunch	102(51%)
Dinner	18(9%)
With tea	12(6%)

Table: 16 Duration of Constipation

1-6 month	24(12%)
7-12 months	36(18%)
1 yr to 1.6 yr	54(27%)
more than 2 yr	86(43%)

Table: 17 Sleep patterns of the patients

Normal	38(19%)
Disturbed	162(81%)

Table: 18 Psychological factors

Chintanat	89(44.5%)
Achintanat	111(55.5%)

Table: 19 Stress/strain in the profession

Present	128(64%)
Absent	72(36%)

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Table: 20 Type of Koshta of the patients

Mridu	59(29.5%)
Madhyama	109(54.5%)
Kroora	32(16%)

Patient assessment questionnaire for Constipation:

Table: 21 Time period to defecate

10 min	75(37.5%)
15 min	88(44%)
20 min	28(14%)
More than the regular	9(4.5%)

Table: 22 Strain during defecation

Yes	No
181(90.5%)	19(9.5%)

Table: 23 Frequency of stool/day

Once	Twice	Trice
129(64.5%)	45(22.5%)	26(13%)

Table: 24 Consistency of stools

Consistency of stools			
Lumpy	Lose	Hard	Grand Total
43(21.5%)	9(4.5%)	148(74%)	200

Table: 25 Duration of lumpy hard stools

One month	2 months	3 months	>3month
73(36.5%)	64(32%)	43(21.5%)	20(10%)

Table: 26 Feeling of sensation of incomplete evacuation

Yes	No
159(79.5%)	41(20.5%)

Table:27 Sensation of ano-rectal obstruction/blockage

Yes	No
141(70.5%)	59(29.5%)

Table: 28 Manual to facilitate defecation

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Yes	No
70(35%)	130(65%)

Table:29 Consuming adequate dietary fibre in the form of fruits/vegetables/whole grains

Yes	No
23(11.5%)	177(88.5%)

Table:30 Doing adequate physical exercises

daily	alternate	weekly	not at all
52(26%)	39(19.5%)	18(9%)	91(45.5%)

Table:31 Drinking adequate number of fluids in the following forms

Water	Juice	Buttermilk	milk
120(60%)	46(23%)	10(5%)	24(12%)

Table: 32 Taking bulk forming agents

Yes	No
9(4.5%)	191(95.5%)

Table: 33 Taking osmotic agents

Yes	No
6(3%)	194(97%)

Table:34 Chronic Proctalgia & tenderness during posterior traction on the pubo-rectalis

Positive	Negative
137(68.5%)	63(31.5%)

Table:35 Pain & burning sensation during & after defecation

Present	Absent
185(92.5%)	15(7.5%)

191 subjects feel pain & burning sensation during & after defecation.

Surgeon's assessment method by specific examination on Fissure in Ano:

Table: 36 Presence of longitudinal tear/ulcer at the verge of anus

Positive	Negative
137(68.5%)	63(31.5%)

In this study, 185 subjects have shown the presence of longitudinal tear/ulcer at the verge of anus & same is absent in 15 subjects.

Table: 37 Test for Pelvic Floor Dysfunction

Hypo-state	Hyper-state	Lax-state

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10(5%)	187(93.5%)	3(1.5%)

Table: 38 Prolonged pain after defecation

Yes	No
165(82.5%)	35(17.5%)

Table: 39 Streak of blood to the stool

Present	Absent
166(83%)	34(17%)

Discussion:

The vast majority of grains consumed by the populations are refined and the outer germ and bran layers are removed to leave only the starchy endosperm. In modern milling processes the anatomical components of the grain are fractionated during milling to produce whole grain flour. This is evidence that such flours are nutritionally different than traditional stone-ground flours where the grains are crushed without separation of the component fractions. The whole wheat grain when grounded with the skin and germ layers yields brownish flour called *atta*. *Atta* existed in the food cycle since ages, but with advancement of time, use of whole wheat atta was out of practice because of modernization in usage of it. People started making *chapathi* with refined *atta* and the resultant effect is suffering from gastro-intestinal problems such as flatulence, constipation haemorrhoids and fissure in ano etc. *Chapahti* is the main filling ingredient in food (breakfast, lunch and dinner), which is a low fibre diet. Excessive intake of wheat roti would be the primary cause for constipation and further the chronic constipation will create a fissure-in-ano.

Fissure-in-ano known as *Parikartika* in Ayurveda which is caused by an unhealthy diet and a sedentary lifestyle. Due to these etiological factors, vitiated doshas get accumulated in the *guda(rectum)* region. This leads to the impairment of *vata*. An aggravated vata causes a low digestive fire, leading to constipation. This causes swelling in the veins in the rectum area leading to pile mass. Passage of hard stool is main cause of tear in lower part of anal canal. The disease is most common in middle age group. Intake of refined wheat flour which is completely devoid of dietary fiber and *rooksha aharas* which are water absorbent in nature (*sangrahi*) leading to constipation. *Apana vata* gets aggravated in its own seat (*pakwashaya*) which blocks the *srotas* (bodily channels), dries them up (of their moisture) and produces obstruction to the movement of feces, flatus and urine by which *parikartika* occurs. As per modern science intake of non-fibrous food will leads to hardening of stools and cause Fissure-in-ano. In this study, it is observed that majority of the patients consume spicier, dry food items, fast food/junk food, consumption of alcohol & tobacco & some patients mentioned drinking inadequate amount of fluids as the etiology. If a person belongs to *mridu-koshta* or in *mandagni avasthaa*, the ingestion of *ati-rooksha, ati-teekshna, ati-ushna, ati-lavana ahara* causes vitiation of *Pitta* and *vata* and produces *Parikartika*. Some of the patients also mentioned - intake of more vegetables, fruits & some patients mentioned drinking adequate amount of fluids get relieved their problems. Instead, whole wheat grain flour is rich in carbohydrates,

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dietary fiber, proteins and minerals. Wheat bran helps in managing constipation as it adds bulk to stools due to its *guru guna* and helps in their easy passage mainly due to its laxative property because of its *sara* guna. This helps in easy expulsion of stools and corrects constipation. Outcome of this study highlighted the awareness in the society about common symptoms like distension of abdomen, constipation and fissure-in-ano by the consumption of wheat roti on a regular basis.

Conclusion:

Parikartika is very common among ano-rectal diseases due to improper *ahara-vihara*. The health of an individual depends solely on his diet and lifestyle. Diet plays very important role in *Parikartika* which is evident by references. Improper dietary regimen and stressful life is found to have influenced the high incidence observed today. Passage of hard constipated stools is the prime cause of tear in the lower anal canal which results in excruciating pain during and after defecation, the cardinal feature of Fissure-in-ano. The *chapathi* (wheat roti) when eaten more eventually become the risk factor for fissure-in-ano.

Conflicts of interest: None

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List of References:

1. Prof: P.V.Sharma;Vaidya Yadavaji Trikamji Sharma; Charaka Samhita, Sutra sthana chapter 27/10, pg-369,. Chaukhambha Samskruta Sansthana. Ed.07. Varanasi.
2. Prof: P.V.Sharma; Vaidya Yadavaji Trikamji Sharma, Charaka Samhita Sutra sthana Chapter 27/21, pg-371, Chaukhambha Samskruta Sansthana. Ed.07.Varanasi.
3. Prof: P.V.Sharma; Vaidya Yadavaji Trikamji Sharma, Charaka Samhita, Sutra sthana Chapter 06/25, pg-97. Choukhambha Samskruta Sansthana. Ed.07.Varanasi
4. Anna Moreshwar Kunthe, Navre, Pandit Harishastri Paradkar; Hemadri, Sarvang Sundar Teeka on-Vagbhata-Ashtang Hrudaya Sutra sthana Chapter 06/16,pg-87. Ed-Reprint, Krishna das Academy. Choukhambha Press, Varanasi.
5. Siddhi Sthana of the Charaka Samhita and Bhela Samhita.
6. Presutti, John; et al. (2007-12-27). "Celiac Disease" American Family Physician 76 (12): 196–1802.
7. Hill, I. D., Horvath, K., and Fasano, A., Epidemiology of celiac disease. 1: Am J
8. Gastroenterol.1995 Jan; 90(1):163-4
9. Fukudome, S. et al, Release of opioid peptides, gluten exorphins by the action of pancreatic elastase. FEBS Lett. 1997 / 412 (3) / 475-479. , Fukudome, S. et al, Gluten exorphin C: a novel opioid peptide derived from wheat gluten. FEBS Lett. 1993 / 316 (1) / 17-19.
10. Fukodome, S. et al, Opioid peptides derived from wheat gluten: their isolation and characterization. FEBS lett. 1992 / 296 (1) / 107-111.
11. PUBMED CENTRAL, TABLE 1: INT J CLINICAL PRACTICE.2007 JULY, 61 (7:1181-1187)
12. www.ncbi.nlm.nih.quv/pmc/articles/pmc1974804/table/tbL1
13. Singh G, Kahler K, Bharathi V. Constipation in adults: complications and co morbidities. Gastroenterology 2005; 128(Suppl 2): A154. (Rome III Diagnostic Criteria for Functional Gastrointestinal Disorders)
14. Mitra D, Davis KL, Baran RW. Healthcare costs and clinical sequelae associated with constipation in a managed care population. Am J Gastroenterol 2007; 102
15. Anal Fissure Causes, Diagnosis & Treatments - Clinical Key
16. https://www.clinicalkey.com/topics/gastroenterology/anal-fissure.html

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 12, Iss 07, 2023

17. Moreshwar Kunthe, Navre, Pandit Harishastri Paradkar, Hemadri- ayurveda rasayana teeka on-Vagbhata -Ashtang hrudaya-sutra sthana,06/16,pg-87. Ed-Reprint, Krishna das Academy. Choukhambha
18. Moreshwar Kunthe,Navre, Pandit Harishastri Paradkar, Hemadri- Ayurveda rasayana teeka on-Vagbhata -Ashtang hrudaya-Kalpasiddhi sthana,03/15 ,pg-750. Ed-Reprint, Krishna das Academy. Choukhambha press-Varanasi.)
19. Chong PS, et al. Haemorrhoids and fissure in ano. Gastroenterology Clinic North America 2008; 37: 627–44.
20. Wheat.| Wikipedia, the free encyclopedia. https://en.wikipedia.org/wiki/Wheat#As_a_foo d.
21. Gluten.| Wikipedia, the free encyclopedia. Available from: https://en.wikipedia.org/wiki/Gluten.
22. Subhashri, Bindu. Vedon men Osadhiya Sutra, edited by Prof. Satya Deo Dubey, Chaukhamba Vishvabharati, Varanasi. 1st Edition, 2010, 183.
23. Agnivesha. Charaka samhita- Agnivesha treatise refined and annoted by Charaka, redacted by Dridhabala Ayurveda Deepika commentary by Chakrapanidatta, edited by Yadavji Trikamji Acharya, Varanasi: Chaukhamba Prakashana; reprint, 2011, 738.
24. Sushruta, Sushruta Samhita. Vol I (Edited with Ayurveda Tattva Sandipika) by Shastri Kaviraja Ambikadutta, Varanasi: Chaukhamba Sanskrit Sansthan, 12th Edition, 2001, 879.
25. Vaghbhatacharya. Ashtanga Hridayam with Sarvangasundhara of Arunadutta and Ayurved Rasayana of Hemadri, collated by Dr.Anna Moreshwar Kunte and Krishna Ramachandra Shastri Navre, Varanasi: Chukhamba surabharathi prakashan, Reprint, 2010, 956.
26. Harita Samhita. Edited by vaidya jaymini Pandey, Varanasi: Published by Chowkambha visvabharati, 2010, 544.
27. Bhela, Bhela Samhita, moola matra. Shukla S G, Varanasi: Choukambha Surabharathi Prakashana: Reprint, 1999, 285.
28. Sri Chakrapanidatta. Chakradatta with Vaidyaprakasha Hindi commentary, by Dr.Indradev Tripathi, edited by Prof.Ramanath Dwivedy, Chaukhamba Sanskrit Bhawan, Varanasi, Reprint, 2010, 542.
29. Bhavamishra. Bhavaprakasha, with English translation, Notes, Appendics and Indices, translated by Prof. K R Srikantha Murthy, Varanasi; Chowkambha Krishnadas Academy, 2, 4th Edition, 2009, 571.
30. Bhavamishra. Bhavaprakasha Nighantu - Hindi Commentary by K.C.Chunekar. Varanasi: Published by Chaukhumbha Bharathi Academy, 1st Edition, 2002, 984.
31. Kaiyadeva Acharya. Kaiyadeva Nighantu, Pathyapattyavibodhaka, Sampadde Acharya Priyavrit Sharma and Guruprasad Sharma, Varanasi, Chowkambha Orientalia, 1979, 696.
32. Narahari Pandit. Rajanighantu, VyakhyakaraDr. Indradev Tripati, Chaukhamba Krishnadas Academy,Varanasi, 3rd Edition, 2003, 703.
33. Madanapala Nrupa. Madanapala Nighantu, Published by Ganga Vishnu Sri Krishnadas, Bombay, 1867, 296.
34. Bhogika Mahendra. Dhanwantari Nighantu, Commentary by Sharma Guruprasad, Edited by Sharma Priyavrat, Varanasi, Chowkambha Orientalia Publication, 2nd Edition, 1998, 360.
35. Sharma P V. Priya Nighantu, along with Hindi commentary entitled Padma, Varanasi, Chaukhamba Surabharathi Prakashan, 2nd Edition, 1995, 275.
36. Nighantu rathnakara, edited by Bhishagvarya navra Krishnashastri, Published by Jawaji Vasudev, Bombay, 1936, 808.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 12, Iss 07, 2023

37. Acharya Shodala. Shodala Nighantu, Commentary by Pandey Gyanendra, Edited by Prof Dvivedi.R.R, Varanasi, Chowkambha Krishnadas Academy, 1st Edition 2009, 538.
38. Lala Shaligrama Vaidhya, Shligrama Nighantu. Mumbai: Khemaraj Shrikrishnadas publication, 2007, 333.
39. Kirtikar and Basu. Indian Medicinal Plants with illustration, Orientalia enterprises edited revised by Blatter.E, Caries.J.F and Mhaskar.K.S, 2nd Edition, 2001, 592.
40. Sri Vaidya Bapalal. Nighantu Adarsha, Varanasi, Chaukhabha Bharati Academy, Reprint, 2007.
41. Pandey Gyanendra, Dravyaguna Vignana. Chaukambha Bharathi Academy,Varanasi: republished in, 1, 2004, 943.
42. Kaviraja Sen Govinda Das. Bhaishajya rathnavali with Siddhiprabha Hindi commentary by Prof. Mishra Siddhinandan, Varanasi; Choukambha Surabharathi Prakashana, Reprint, 1st Edition, 2007, 1196.
43. The Wealth of India (Raw materials), Council of Scientific and Industrial Research, New Delhi, Reprint, 10, 2005, 591.
44. Acta Chimica Slovaca. Chemical composition and nutritional quality of wheat grain Zuzana Šramkovaa, Edita Gregovab, Ernest Sturdíka, 2(1), 2009, 115-138.
45. Google, http://nof.org/files/nof/public/content/file/344/ upload/159.pdf.
46. http://archive.gramene.org/species/triticum/wh eat_taxonomy.html
47. Ghulam Khan M, Shahid Ansari H, Feroz Ahmadb. "Pharmacognostic standardization, antioxidant and free radical scavenging activity of the seeds of Triticum aestivum L - A dietary staple", Published in: Journal of Young Pharmacists, 5(2), 2013, 54-59.
48. Roshan K, Rathore K S, Bharkatiya M, Goel P K, Naruka P S, Saurabh S S, Therapeutic potential of Triticumaestivum Linn. (Wheat Grass or Green Blood Therapy) in the treatment and prevention of Chronic and Acute Diseases: An Overview, PharmaTutor, 4(2), 2016, 19-27.
49. Bh Lakshmi V S, Malla Sudhakar, Jyotsna Sudha F, Venu Gopal M. Ameliorative effect of Triticum aestivum linn against experimentally induced arsenic toxicity in male albino rats, Der Pharmacia Lettre, 7(1), 2015, 202-211.
50. Raja Radhakantadev. Shabdha kalpadruma, Delhi: Naga Publishers, 3rd reprint, Vol I to Vol V, 1st Edition, 2006.
51. Sastry J L N, Dravyaguna Vijnana. Vranasi, Chaukhamabha oreintalia, 1, 2nd Edition, 2004, 440.
52. Saxena and Saxena. Plant Taxonomy, MeerutPragati Prakashana, 4th Edition, 2004
53. Dwarakanatha C. Introduction to Kayachikitsa, Varanasi; Chowkambha Orientalia, 3rd Edition, 1996, 399.
54. Byadgi P S. Ayurvediya Vikriti Vijnana and Roga Vijnana, Chaukambha Publications, New Delhi, 1st Edition, 2009, 544.
55. Oliver, Jamie. "Roshi (maldivian roti)". Jamie Oliver. Retrieved 18 February 2017.(recipe)
56. Archived 2008-12-11 at the Wayback Machine Ain-i-Akbari, by Abu'l-Fazl ibn Mubarak. English tr. by Heinrich Blochmann and Colonel Henry Sullivan Jarrett, 1873–1907. The Asiatic Society of Bengal, Calcutta, Volume I, Chap. 26, page 61.
57. Nandita Godbole, 2016, Roti: Easy Indian Breads & Sides.
58. Chitra Agrawal, 2017, Vibrant India: Fresh Vegetarian Recipes from Bangalore to Brooklyn, page 35.

ISSN PRINT 2319 1775 Online 2320 7876

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59. Jump up to:[a b c] Kraig, Bruce; Sen, Colleen Taylor (2013). Street Food Around the World: An Encyclopedia of Food and Culture. ABC-CLIO. p. 124. ISBN 978-1-59884-954-7.
60. "India Curry.com About Wheat". Archived from the original on 24 September 2015. Retrieved 20 July 2015.
61. [a b] Phulka Roti Recipe, How To Make Phulka Chappati At Home April 26, 2015 by Gopi Patel Under the heading A few tips for beginners, no. 10 is: This is Gujarati phulka roti recipe where I have not added salt. However you can add salt and season your dough while kneading dough for phulka roti.
62. Caballero, Benjamin; Finglas, Paul M.; Toldra, Fidel, eds. (2015). Encyclopedia of Food and Health. **1**. Elsevier. p. 731. ISBN 978-0-12-803511-5.
63. "Roti-makers for quick and efficient preparation of rotis & pooris - Times of India". The Times of India. Retrieved 23 August 2020.