

## Scientific Backing of Rice Based Food Blends-Indian and Foreign Brands of Khichadi

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**Received:** November 14, 2017; **Published:** November 29, 2017

### Abstract

A food blend *khichadi* is commonly occasionally eaten, quickly cooked food, basically made from rice, dhal and occasionally mixed vegetables, called with varying names in different regions and countries, differing with some alterations of ingredients. It is accepted as *Prasad* in different Holy shrines. It is good for digestion, gets prepared quickly and eaten fresh with some supporting pickles and chutney, curd, butter milk, butter and *ghee* etc. Its qualities and feelings on its good aspects are expressed in varying regions, but it still lacks reasonable scientific backing. South East Asia, largely rice eater, in past suffered beriberi disease, Vitamin A deficiency and some other disorders, therefore, it calls for scientific analysis and get to know to follow right path. Objective of this study was to critically analyze discrepancy in food quality and find ways of improving brand to make khichadi a standard ideal food so as to establish national prestige. New brands become pro- vitamin food for fulfilling all round quality of perfect food. Thus, nutritious khichadi and supplementary food items will come in support of new theme, 'food is medicine' and eliminate rice based food toxicity viz, fluorosis, and arsenic etc. It requires development of ancillary aspect to keep nation off from food related risk and not revert back to the worsening situation, as it happened in the past.

**Keywords:** Continental foods; Festival seasonal and Devinal Prasad; Food supplements; Proteins; vitamins and Minerals

Volume 2 Issue 2 November 2017

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### Introduction

Food is third basic primary human need following in order of priority first fresh air to breath and second potable quality of water to quench thirst. Food is eaten in breakfast, lunch and dinner. The *khichadi* a rice based food blend becomes food for either breakfast, lunch or dinner, depending on mood of the eating persons, ease of preparation and time saving. *khichadi* has been popular as light food, which is known to facilitate digestion and easily digestible by young children and people after prolonged sickness. In northern India, a festival of rice named as *khichadi*, "Maker Sankranti", fixed to occur on Jan 14, every year", is celebrated after harvest of rice crop. On this festival day, largely khichdi is eaten once in a day to avoid pan cake (roti) or deep fried food poodi etc. The consistency is a factor in naming *khichadi*.

**Citation:** RC Yadav and Iaya Yadav. "Scientific Backing of Rice Based Food Blends-Indian and Foreign Brands of Khichadi". *Nutrition and Food Toxicology* 2.2 (2017): 317-331.

When rice and dhal is cooked by frying before boiling and vegetable and spices added, it becomes a fragrant food, generally known as fried rice in restaurants and polav in house hold dialect. In some regions, particularly Rajasthan, it is also called khichadi, hence it will be highly confusing with respect to quality and specialty of ingredients and preparation as well as consistency of meal served for eating.

The rice main ingredient of *khichadi* had been staple diet in south East Asia. There occurred deficiency of Vitamin A in rice that caused wide spread disease Beri-Beri in the region. So far there has been no rice variety that contain vitamin A. Due widespread advancements in medical facilities, the menace of beri beri has got suppressed and not totally eradicated. Another a wide spread disease known as 3D diseases viz dysentery, dermatitis and dementia, which had been known as genetic disease. This aspect implicates important sociological humiliation. This stigma needs finding real reason for its occurrence, which has been overdue for scientific community reach to definite conclusion.

It is imperative to look at the past scenario about rice. In this situation one needs to review food situation prior to the green revolution and introduction of high yielding wheat varieties. In the time prior to the first green revolution, rice was the main food and supplemented by other course grains. About 50% of world population, specially concentrating in South East Asian countries, rice remained deficient in vitamin A, B2 and lycopene which are deficient in rice. Food and Agricultural Organization (FAO) report strongly support ailment, which caused wide spread disease viz beriberi, affecting brain, skin, nervous system. Scientific reports exist that development of child brain gets to full growth within two years of age, although its functioning acquires after two decades of birth.

Thus, weakness of any kind of nutrition will affect country gentry. After import of red wheat from America and subsequently launch of green revolution lead wide spread land improvement, intensive irrigation, fertilized and integrated pest management, which lead to high rate of siltation in rivers as well as water bodies. Low lands improved by land reclamation measures got occasionally flooded and released methane and hydrogen sulphide, which caused variety of malaria disease, dengue, chikangunya and cancerous deaths in prominent wheat growing state of Punjab (Kaur and Sima, 2015). Wheat food related serious disease is, celiac disease (Gupta, 2000). This has been wide spread health hazard (Yadav, 2015c).

Varieties of health hazards arising from vitamin deficient rice, and wheat based disease are reported by Yadav (2015c). Many innovative researches were published (Yadav 2013 a, b and 2015c).

Now again a new wave of *khichadi* in India has emerged, wherein it is being poised to be declared as the national food. It needs to be recalled that rice, the main grain of *khichadi* is deficient in Protein, Vitamin A, and Vitamin B2. Certain percentage of population comprising, children, pregnant ladies and elderly gentry have no access to non-vegetarian diet or dairy product. The essential amino acid content viz tryptophan, which gets converted in to vitamin B1- Thiamin support nervous system, digestion and binding tissues for bones. The gentry deficient in Tryptophan and Thiamin will suffer unstable mind, become lethargic and have nervous disorders. Western countries are very conscious about the wheat based celiac diseases, which are indicated to be non-curable and person suffering with celiac disease has to remain on non-celiac dietary foods (Gupta, 2000).

Therefore, it warrants understanding pros and cons of such provocation about *khichadi*. It needs clear understanding of food quality that will be emerging and causing other types of complications in public health. Objective of present study was to give a scientific backing to *khichadi*, which is poised to be a nation heritage food of India, as national prestigious food and create a scientific brand of *khichadi* as ideal hunger eliminating ideal healthy food.

#### **Nutritional facts about *khichadi***

Television and daily newspapers focused khichadi as being poised to be declared as Indian national food, as many other countries of the world have made their national foods, veg Berger of Britain and pasta of Italy. The reports focus digestibility, ease of preparation, taste etc. as novel feature of khichadi. The word khichadi has become item for literary gossip, criticism and passing bad remark on things, culture and habits. However, there has been no single appraisal on the scientific backing. Reports of print media are extracted and information on scientific relevance are drawn (Table 1).

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S. No	Name and region	Ingredients	Pro vitamin	Discrepancy	Improvement
Indian scenario					
1	Himanchal Khichadi	Rice, black gram or rajma	Carbohydrate, protein, spceces and salt	vitamin A and VitaminB etc	Add vit min A and Lycopinn
2	Kima khichadi , Andhra Pradesh	Rice, minced meat and spices	carbohydrate, fat and protein	vitamin A, vitamin B complex and lycopene etc.	Add vita min and lcopin etc.
3	Bisi bole bhat < Karnataka	rice, dhal vegetable and tamarind	carbohydrate, protein, vitamins and vitamin C	Vitamin A and VitaminB2	Add vitamin A, and lycopene
4	Garhwali Khichadi, uttarakhand	Rice, Urad Dhal, rai and Spices	carbohydrate, pro vitamin,	vitamin, A and Lycopene	Add vit A and B2
5	Rajasthani khichadi	Rice, variety of pulses, bajra and un grinded spices.	Carbohydrate, protein, spices	Vitamin A and B complex	Add vitamin A and lycopene
6	Balach Maharashtraian Khichadi	Rice, mung, 20 groundnuts and spices.	carbohydrate, protein minerals,	Vitamin A , lycopene and B2	Add Vit A Lycopene and B2
7	Guajarati chichi	Rice, turmeric salt and	carbohydrate, turmeric, curry leaves and mustard seeds etc.	protein, Vitamin A and B2, Lycoming	Add Vitamin A, lycopin and protein
Foreign Khichadi brands					
8	Risotto Italian Khichadi	Rice, fish, meat, butter	protein carbohydrate and spices	vit A, lycopene	Add Vit A, B complex
9	Payala, Spain	Rice, Chicken, fish, green vegetables,,kesar, beans and rose merry,	Carbohydrate, vegetable protein, animal protein and spices.	Vit A, Lycopene B2	Add vit A and lycopene , B2

**Table 1:** Nutritional status of khichadi in different regions of India and abroad.

**Reference:** Hindustan (newspaper). 2017. Khichdi videsh me bhi bade chause khate hain (Khichadi is also eaten with keen interest in foreign countries). Hindustan, Nov 4, 2017.



**Figure 1:** Ingredients of Bisi bele bath powder, for Khichadi brand in Karnataka. The ingredients are fried in different heat sensitive items lots to enhance flavors, grounded to make powder and used as spice for Bisibele bath.

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The main ingredient of *khichadi* is rice, dhal, spices for flavor and salt to taste. Sometimes it is prepared as special rice dish as polao and with different names with addition of vegetable. The rice food grain does not contain Vitamin A, it contains low tryptophan, an essential amino acid that forms vitamin B1, thiamin that supplements nervous system, muscle tissue and bones etc. It also lacks in lycopin, which is very vital food nutrients. In many states *khichadi* even turmeric is added, but not protein. For example Gujarati *khichadi* is nutritionally even protein deficient *khichadi*. The tryptophan which is low in rice gets absorbed in body when it is eaten with fish, meat ie non- vegetarian diet. West Bengal being main rice eating state, people eat invariably fish in daily diet, hence tryptophan absorption is normal. On the other hand, in Andhra Pradesh meat is mixed in Khichadi, which is named as *Kemah khichadi*. Hyderabad famous biryani is special delicacy in south India. Karnataka *khichadi* is a preparation of rice mixed vegetable blended with specially prepared powder the foreign brand of *Khichadi* among many, Risoto of Italy and Payal of Spain, both khichdies do have nutrition deficiency of vitamin A, B1 (Thiamin), B2 Riboflavin, B3 Niacin and lycopene, cooked with chicken and meat. In spite of all preparations both vegetarian and non-vegetarian *khichdies* are deficient in proteins, vitamins and minerals.

Spice for *Bisibelebhat* is a powder of ingredients that add flavor, colour, taste and some minerals such as Mn an Mg etc. which help maintain homeostatic of the body, i.e. keep body biochemical reaction in balanced form (Hindustan, 2017). This is new addition to knowledge that there is spice to enhance delicacy of rice preparation such as *khichadi*. Already known such powder is *Sāmbhar*, which is for enhancing and creating entirely new taste for dhal, a complementary item of food, be it rice or wheat made *chapatti* (pan cake).

### **Materials and method viz. substantiation of evidentiary facts**

#### **FAO report on beriberi**

It is well established fact that rice does not contain vitamin A (Yadav, 2014b), remain deficient in Vitamin B1 cause nervous weakness (Gupta, 2000). Food and Agriculture Organization (FAO) of United Nation's document (Gupta, 2000) is referred to substantiate this aspect of weakness in *khichadi* containing main ingredient rice.

#### **New cropping practice for making shortfall in per capita availability of protein.**

An innovative practice devised in another study (Yadav, 2017) is referred to create sufficiency of wide spread shortages of protein. Protein content is not adequate; hence such development will aid help acquiring protein sufficiency for large national consumption likely to increase in future.

#### **Vitamin deficiency**

Vitamin A deficiency in food causes night blindness (Gupta, 2000), which is well known fact. Further, deficient tryptophan gets absorbed with non-vegetarian meal or eaten with dairy product (Horobin, 2003).

#### **Improvement strategy**

Strategy is to improve dietary nutritional weakness in *khichadi* so that no such ailments develop by eating new innovatively improved brand in *khichadi*.

#### **New Ideal brand**

A new brand of *khichdi* is prepared. Another new item that is acceptable for both rice and non-rice eaters is made from good quality carbohydrates of wheat, barley, maize, parboiled rice, finger millet, pearl millet, proteins by adding gram. This flour has better content and less prone to cause celiac disease and rich in protein and vitamins dealt with earlier part of the study. This flour is useable for making special gluten free pasta. This gluten free food item is new brand of pasta, which can be taken as one two diets per week to enhance nutrition, a fast food preparation and stress relieving with different taste.

#### **Moniroring and evaluation**

Simple clinical information are devised to produce data on different nutritional deficiency and improvement.

**Results**

A brief description is presented here to appraise, in general, as every individual is eating food so one should know about the quality of food.

**Nutritional facts**

**Proteins**

Proteins are large molecules that are formed by biological polymerization of amino acids derived from the nitrogen content of foods. The occurrence and circulation of the nitrogen cycle, its good and bad effects on productivity and environment supplementation of greenhouse gases (GHGs) is presented by Yadav, (2014a). Each protein produced has a specific structure and function. Proteins by their actions enable living cells to grow and perform all activities necessary for its survival. There are 20 common amino acids and proteins are constituted by these building blocks. Plants are able to form all the amino acids they need, but human and animals must obtain some of them from foods. The proteins constitute one or more chains of amino acids, having different characters acquired at the molecular levels of the amino acids, the chains and their sequences linked together by peptide bond (Gupta, 2000). These scientific facts further equipped for making design considerations for development of ideal brand of khichadi in the present study.

A new estimate of 0.75g /kg body weight/day good quality highly digestible is reported as normal protein requirement (Gupta, 2000). The level of lysine and tryptophan in cereal prolamin and methionine and cysteine in legume globulins are beneficial to human (especially vegetarians), dependent on these seeds for essential amino acids.

All proteins must be broken down in their constituent amino acids to be used by human cells. Normally only amino acids and (certain small peptides) are absorbed in the small intestines via mucosal cells in to hepatitis portal veins. Studies have shown that absorption and utilization of proteins are optimized when adults evenly distribute their protein intake throughout the day.

In plants storage of proteins can be increased by enhancing use efficiency. The enhancement of harvest index can be regarded as an economic trait with improvement potential to more efficient use of resources. Spring wheat have higher protein content than winter wheat, the nutritional value of the winter wheat protein is superior.

Twenty (20) amino acid found in human tissues come from dietary proteins in food. Among them nine (phenylalanine, leucine, isoleucine, tryptophan, lysine, threonine, methionine, valine and histamine) are essential to human diet, because they cannot be synthesized in body. In addition, two amino acids cysteine and tyrosine in the diet can spare their parent amino acid of methionine and phenylalanine, respectively. The amino acids with the lowest scores in the listed food (lysine in wheat and barley flour, methionine in soybean, potato and 'cow's milk and in rice and maize) are those that should be paid attention to limiting amino acids for body's nutrition.

Food	Sulphur amino acid								
	He	Leu	Lys	Phe	Met	Total	Thr	Try	Val
Ideal protein	370	306	270	180	144	270	180	90	270
Barley	240	430	210	310	90	220	230	90	310
Maize	293	827	179	284	117	197	249	38*	327
Rice	322	535	236	307	142	222	241	65*	415
	(119)	(175)	(87)	(175)	(99)	(83)	(134)	(72)	(154)
Wheat flour	262	442	126	322	78	192	174	69	262

*Table 2: Essential amino acid composition of foods a, b.*

The figures expressed amino acid contents as mg/g protein, b. Figures in parenthesis expressed as ratio (percent) of the food to that in the ideal protein,

\*The prime limiting amino acid.

As revealed in Table 2, Tryptophan is limiting factor in maize and rice. To produce 1 mg niacin 50mg tryptophan is required. From the requirement of niacin (Table 3) large quantity of tryptophan is needed. When khichadi is used as sole meal, it is not sufficient to produce required amount of tryptophan to supplement niacin. The volume of rice eaten taken up in khichadi will not be sufficient to produce required amount of Tryptophan that in turn converts required doses of niacin. Hence there will occur chronic discrepancy of nutrient niacin in all ages of gentry.

It is clear from the values that rice content of protein in six of nine sulphur containing amino acid is highest for He, Lysine, Met, Total and Val and at par with two other highest viz Phe and Thr. The low content of Tryptophan that gets converted by the lever in to niacin becomes limiting quality of rice, which caused beriberi disease in the early time. This deficiency of niacin is supplemented by vitamin B6. Although beriberi is not in existence to that severeness, mild effect might be persisting among the sole dependents on rice.

Country	Supply, mg/d	Remark
France	112.7	Highest
USA	110.7	
Italy	106.9	
USSR	106.7	
Spain	101.4	
Poland	101.4	
Japan	95.2	Lowest in developed country
China	62.9	Highest in developing country
India	54.4	
Ethiopia	51.5	
Nigeria	49.8	Largely root crop eating country
Thiland	49.0	Largely rice eating country
Phillipines	48.5	Largely rice eating country
Bangaladesh	43.0	Lowest

**Table 3:** Total protein supply in some countries, per capita, mg/day.

Source: FAO, 1989, cited in Gupta 2000.

There is contrast difference between protein consumption across the countries (Table 3), Bottom most three countries are rice eaters. There cropping sequences are rice after rice and have poor utilization of atmospheric nitrogen or nitrogen cycle due to existence of predominant wet condition. The top four countries with high protein availability are rice importing or concentrating as best variety cultivating countries. Limitations, alternatives and prospects are different in different countries. This aspect will be taken up in the result and discussion part of the study.

Beans and rice are incomplete proteins which can be made in complete protein by adding meat, fish, egg, cheese and milk. Thus, the rice growing country’s incorporate fish, duck as composite practice, which enable produce nutritional food from their farming system. This fact becomes justification of popular practice of rice-fish-duck, pigeon pea, papaya and banana growing in prominent rice eating states of Eastern India, South East Asia and China.

**New cropping practice for making shortfall in per capita availability of protein.**

The intercropping doctrine evolved by innovative application of scientific facts of management of nitrogen cycle is new technology to bring multiple benefits and conserve resources for present and posterity (Yadav, 2017). The yield plateaus and direction of agriculture practices transformed from empirical to quantum mechanics of fixed mode. It requires optimization of various constituent components. The research has potential to bring new agriculture in the world to develop sufficient quantity, quality and biodiversity and protection of environment free of nitrous oxide emission.

**Vitamins**

**Vitamin A**

Vitamin A is necessary for normal growth and developments. Vitamin A deficiency may result in damages of eyes; ulceration and destruction of cornea, then blindness.

WHO regions	Children 0-5 years with xerophthalmia (1991)	
	Number, million	Prevalence, %
Africa	1.3	1.4
Eastern Mediterranean	1.0	2.8
Latin America	0.1	0.2
S.E. Asia (including India)	10.0*	4.2
W Pacific (Including China)	1.4	1.3
Total	13.8	2.8

**Table 4:** Prevalence of vitamin A deficiency in regions WHO, 1993, Cited in Gupta, 2000).

\*Severe problem

Lycopene is reported to enhance carotene uptake. The subjects who consumed diets rich in carotenoids developed fewer lung cancers, whether or not they smoked.

Leafy vegetables such as spinach, amaranth, coriander, drumsticks leaves, as well as ripe fruits such as mango, papaya and yellow pumpkins are good source of beta carotene. Generally deep dark vegetables contain more beta carotene than white or light vegetable such as cabbage and lettuce. Large intakes of vitamin A, in time of plentiful availability, are stored in liver and help body tide over period of shortage.

**Vitamin B complex**

**Vitamin B1 (Thiamine)**

The thiamine found in rice is necessary for catalyzing the oxidation of carbohydrates in the body. This reaction releases energy in the system. Thiamine helps in the normal functioning of heart and nervous systems. Beriberi, the thiamine deficiency disease is basically neurological condition that sometimes involves the cardiac muscles and paralysis of involuntary muscles. Thiamine absorption occurs in two separate processes. At low concentration (5mg/day) thiamine is actively absorbed, but at higher concentration (8-15mg/day), its absorption becomes passive. Thiamine is transported as a free Vitamin in circulation. Formal elements of blood contain predominantly, thiamine pyrophosphates (TPP) a co enzyme. Plant sources include pulses, nuts, oil seeds and whole grain cereals. Parboiled rice and fresh peas are good source of thiamine. Leafy green vegetables are good source of thiamine. Some symptoms of thiamine deficiency observed are mental depression, moodiness, irritability, forgetfulness, confusion and fear. Severe deficiency of thiamine leads to *beri beri* a disease of nervous systems.

**Vitamin B<sub>2</sub> (Riboflavin)**

Vitamin B<sub>2</sub> deficiency is characterized by variety of clinical signs and symptoms specific to mucous membrane and skins, which in many cases duplicate symptoms seen in deficiency of other B complex vitamins. The plant produced vitamin (details contained in Gupta, 2000), support scientific facts for development of designer quality rice (Yadav, 2014 a,b). Lack of riboflavin affects the eyes, skins and nerves. The eye lids become rough and the eye become sensitive to bright light. This condition is called photophobia. The skin changes are found around the area of mouth, on the lips, tongue and nose. Lips become inflated, cracks are observed in the corners, of mouth and tongue becomes sore. Sometimes tongue gets swollen. The deficiency systems can be corrected by administering riboflavin.

Food	Content, mg/100g	Food	Content, mg/100g
Cereals		Vegetables	
Wheat entire	0.10	Cabbage raw	0.05
Wheat Germ	0.6-0.8	Fresh green peas	0.14
Rice entire	0.06	Potato raw	0.03
Rye Entire	0.20	Sweet corn	0.14
Bread refine	0.07-0.10	Sweet potato raw	0.05
Bread Wheat grain and enriched	0.12	Tomato raw	0.03

*Table 5: Riboflavin content of various foods (After Hui, 1992 cited in Gupta 2000).*

As new innovation, Sandwich made with whole grain bread, peas and sweet corn will be rich B2 containing food supplement. Samosa made from carotene peas and sweet corn will be new A and B2 containing fast food. PROVITAMIN Vegetable Biryani containing carbohydrate, thiamine, vitamin A, Amino acid tryptophan, Niacin, Vitamin C, and Carotenoid should be served with vitamin C. Wheat grass juice is taken by people, for creating freshness and energy in body.

**Vitamin B3, Niacin**

Food items containing Vitamin B3- Niacin (Table 6) contain even more than non-vegetarian food item chicken (Horobin, 2003). The Vitamin B3 gets removed in rice processing. Parboiled rice is good with respect to B3- vitamin Niacin as bran is absorbed in carbohydrate. Parboiled rice is also known to be relatively free from arsenic a toxic poison. This aspect is gaining scientific consideration in export of rice in global market.

Age group	Age range	Niacin, mg	Dietary tryptophan (1 mg niacin is derived frpm 50 mg dietary tryptophan)
Infant	0-0.5	5	250
	0.5-1.0	6	300
Children	1-3	9	450
	4-6	12	600
	7-10	13	650
	Males	11-14	17
	15-18	20	1000
	19-50	19	950
	51+	15	750
Female	11-50	15	750

	50+	13	650
Pregnant		17	850
Lactating		20	1000

**Table 6:** Niacin doses for different age groups.

Source: Audrey, *et al.* 1994 and Gupta, 2000.

The dose requirement of niacin is age sensitive.

Maximum dose of niacin is necessary for age group 15-18 years, followed by lactating ladies and males of higher ages (Table 7).

Top sources	Niacin, mg/100g	K, cal/100g	Protein,mg/100g
Yeast Torula	44	277	39
Yeast Bakery	37	262	37
Rice bran	30	216	13
Rice polished	28	265	12
Sunflower seed	27	339	45
Wheat bran	21	353	16
Cereal bran sugar and malt extract	18	240	13
Peanut roasted and salted	17	570	26
Peanut butter	15	594	25
Cereal bran	14	239	11
Chicken broiler	14	203	33

**Table 7:** Niacin content in food.

Amino acid and vitamin supplement peas, pulses and nutrient fortification possible

**Effect:** Food canal system, Brain, Eyes and Brain and dental

Innovative food with rich niacin can be pan cake made from rice bran served with bakery yeast, which will be better than chicken. Sun flower seed, safflower seed, roasted and salted peanut should form evening snacks to fortify niacin intake.

### Vitamin B<sub>6</sub> (Pyridoxine)

Vitamin B<sub>6</sub> deficiency includes eczema and seborrhea dermatitis in the ears, nose, and mouth, cheilosis, gloss Otis and angular stomata's and hypo-chromic and microcytic anemia. Central nervous system changes such as irritability and depressions.

### Vitamin B<sub>12</sub> (Cynocobalamine)

Macrocytic, megaloblastic anemia and neurological symptoms characterize vitamin B12 deficiency. Alterations in dermatitis occur due to high requirement for vitamin B<sub>12</sub> for normal DNA replication necessary to sustain the rapid turnover of the erythrocytes. Neurological systems are due to demyelization of spinal cord and are potentially irreversible (Gupta, 2000).

### Minerals

Minerals are added in khichadi as in other food preparations. Hence, the mineral can be taken as sufficient or tolerable. This is important part for keeping blood pressure (BP), acidity, anti-oxidant in control.

Now when one it comes to Protein, Vitamin and Mineral content of *khichadi*, it is not adding things to enhance nutritional value, particularly with respect to vitamins A and B1, B2, B3 and lycopene. The component B1 thiamin, B2 Riboflavin, and B3 Niacin need supplementation in *khichadi*.

**Dietary requirements**

For good health protein, vitamins and minerals have been presented in Table 8, for daily food supplement. The vitamins from cereals have different quality characters and names, (Table 8). Vitamins which are oil soluble can be eaten in sufficiently which get stored in liver and released when there occurs short falls, off the seasons. The oil soluble vitamins are A, D, E and K. These vitamins do not get lost while cooking. The water soluble vitamins such as B1, B2, C and lycopene etc. get lost in cooking, hence these water soluble vitamins require due care during cooking. These vitamins are not so stored in body, hence, their daily intake is to be maintained.

Vitamins	Units of measurement	Men	Pregnant and lactating women's
Mandatory			
Vitamin A	μ	5000	5000
Vitamin D	μ		400
Vitamin E	μ	30	30
Vitamin C	μ	60	60
Folic acid	mg	0.4	0.8
Thiamine	mg	1.5	1.7
Riboflavin	mg	1.7	2.0
Niacin	mg	20.0	20.0
Vitamin B <sub>6</sub>	mg	2.00	2.50
Vitamin B <sub>12</sub>	μg	6.0	8.0
Optional			
Vitamin D	μ	400	-
Biotin	μg	0.300	0.300
Pantothenic acid	mg	10.0	10.0

**Table 8:** Recommended daily dietary supplement of Vitamin (Adapted after Hui 1992, Gupta 2000).

The discrepancy in protein and vitamin cause variety of ailments. Sufficient intake of the food as specified theme i.e. “Food is medicine” can save one from such ailments. The good health will eliminate huge medical bills. There occur situations when surgical operations are not performed by medical surgeons on plea of fear of low chance of recovery, hence under such situation, food will be the only stake for elderly gentry of the world. There is good scope to maintain feel good and long life with theme food is medicine (Table 9). It is evident that khichadi weak in nutrients viz protein, vitamin and minerals need some specific supplementation to makeup shortages in nutrition. Many ailments such as that of beriberi, vitamin A deficiency leading to night blindness emerge very fast, Thiamin and niacin deficiency produce disorders, which implicate societal impact and disappointments. In order to get rid of such humiliating physical, mental and social weaknesses the khichadi needs special attenuation on food and nutrition front.

**Strategy for improvement**

Content presented in Table 1 reveal the general discrepancy of nutrients. The most important deficiency was of lack of vitamin A, vitamin B1 Thiamin and vitamin B2 Riboflavin. The protein is supplemented by dhal but, per capita availability of pulse, main source of protein is in short supply, which implicates always conservative use of pulse in khichadi, another factor of deficient nutrients. The short-fall and basic requirement of absorption of thiamin is that it can be absorbed by body when the rice based food is taken together with

meat, fish and egg or with dairy product such as milk, curd and buttermilk. These supplementary ingredients are not at time afforded by the poor people who largely will depend on khichadi or rice based diet. Thus, khichadi has several merit of taste, fast cooking, and many related aspects, it needs improvement with respect to overcoming deficiency of food nutrition.

Vitamins	Health effects
Vitamin A	Immune functions, precarious lesions, (esophageal dysplasia, oral leukoplakia), cancer (breast)
B- Carotene	Cataracts, Precarious lesions (oral leukoplakia), Cancer (lung, cervic, gastrointestinal, stomach, head and neck, esophageal)
Vitamin D	Osteoporosis, blood pressure
Vitamin E	Cataracts, Immune fractions, (Children, elderly) Cancer (lung, all)
Vitamin C	Cardiovascular (mortality, platelet functions) Cataracts, Iron absorptions Cardiovascular (high density lipo proteins, cholesterol, blood pressure, Periodontal disease, cold (symptoms).
Vitamin B <sub>6</sub>	Cancer (gastrointestinal) Carpal tunnel syndrome
Folic acid	Immune function elderly, Birth defects,(neural tube defects, cleft lip/cleft) Precarious condition (Cervical dysplasia, bronchial syno-mous metaplasia in smokers)

**Table 9:** Beneficial health effects of vitamins observed from epidemiological studies (After Hui, 1992, (Gupta 2000).

**New Ideal brand**

Different weakness of khichadi, be it vegetarian, non-vegetarian, different brands of country and abroad have component wise limitations. These components should be fortified by adding and supplementation of week components of ingredients. In addition to style of cooking of khichadi plays important role in consistency of food, and quality. Watery khichadi, is more nutritious because of lycopene and addition of vitamin C, which enhance uptake of vitamin A. and supported by carotenoid (Table 9, 10).

S.No	Deficient nutritional factor	Improvement measure	Improved effect	Backing for improvement
	Essential acid tryptophan			
1	Tryptophan essential amino acid	It is low in rice and maize. This will contribute to low formation of thiamin	Content cannot be improved upon, but take supporting food to boost absorption.	It needs strategic management
	Vitamin			

2	B1-Thiamin	Thiamin is low in rice (Table 3)	Low content should get absorbed by body to cope up with low requirement of thiamin and escape from bad effect of shortfall.	It requires enhance availability of meat, fish, egg and dairy product for coping with nutrient deficient effect of khichadi.
3	B2 Riboflavin	.Fresh green pea and fresh sweat corn should be added to fortify B2.	Lack of riboflavin affects the eyes, skins and nerves, which cause some problem as with thiamin	PROVITMIN Vegetable Biryani containing, carbohydrate, thiamine, vitamin A, Amino acid tryptophan, Niacin, Vitamin C, Carotenoid should be served with vitamin C.
4	B3 Niacin	Eat Niacin rich food items, such as pan cake with khichadi.	It will supplement bone and tissue needed for skeleton	Thus, nutritious khichadi and supplementary food items will come in support of new theme food is medicine
Enhancement of Vitamin from carrot should be with more water in Khichadi.				
5	Lycopene	With tomato	Enhance uptake of Vit A with vit C	Add carrot, pumpkin in rice based food
Bio inactivation of toxicity in rice based foods				
6	Fluoride, toxic salts and gases	Use aerobic rice for preparing khichadi.	Eradicate, problems of dental defects and bone deformations.	Details in Yadav, 2014b
7	Arsenic toxicity	Reduce absorption of arsenic by changing food to Phosphorus rich pearl millet pan cake with khichadi.	Reduce accumulation of arsenic to take long time to reach at level LD50, to enhance longevity of life span	FAO, 2006, Horobi, 2003, Yadav, 2014b

**Table 10:** Constituents for fortification of nutrient contents of khichadi.

From review of nutrient contents of protein, vitamin, minerals, weaknesses in khichadi, it is coming apparent that khichadi should be eaten with pan cake made from rice bran and served with bakery east. Pan cake made from pearl millet should be eaten with khichadi to eliminate absorption of toxic arsenic coming from rice in khichadi. Thus, nutritious khichadi and supplementary food items will come in support of new theme food is medicine (Yadav and Yadav, 2017). Quinoa (*Chenopodium quinoa*, quinoa wild) an indigenous crop of South American countries, Peru, Ecuador, and Bolivia, is spreading very fast in America, Europe and Saudi Arabia. This crop is yet to be introduced in India. The quinoa is better than chicken with respect to niacin content (scientific article under finalization).

### Monitoring and evaluation

Experiences have shown that any one dependent of rice dhal or sole khichadi without support of dairy product for a month will suffer from night blindness, skin disorder and nervous system with instability in mind. Nervousness, moodiness etc.

Simple clinical information can be devised to produce data on different nutritional deficiency and improvement. Such weakness can be monitored by carrying out sample survey or tracing back family food habit of such mental or night blindness suffering patients.

### Discussion

This study enumerated food deficiency and resulting health hazard that occurred in the past. Earlier rice eating had some discrepancies when awareness about scientific knowledge was in primitive stage, wide spread shortage of food needed import of red wheat from United State of America under PL480 scheme. First green revolution brought high yielding dwarf varieties of rice and wheat, these created new sufficiency in India. Wide spread land reclamation, improvement and intensive use of fertilizer and insect pest management

practices and over irrigation resulted in yield in Indogangetic belt popularly known as food basket but at same time it produced micro-biological diseases such as malaria, dengue, chikanguniya and even cancer. Such cases increased in most popular area of wheat and rice production. Celiac disease is menace for wheat eating gentry. Thrust of medical facilities did overcome problem of beriberi, a problem among children and aged gentry.

This study has enumerated prevalent bands of khichadi in different states and foreign bands, the protein is used in almost all khichadi bands, are deficient in vitamin. Protein supporting pulses had been in short supply and costly. In this situation in khichadi dhal is used conservatively, hence even protein content is insufficient. The protein intake in India is low as reported by FAO document. When it comes to vitamin, the situation is equally not so well as vitamin. A is totally absent, vitamin B1, B2 and lycopene are absent. Since, rice is the main ingredients of khichadi, which has no vitamin A, there is no rice variety which contain Vit A. Rice and maize have low content of amino acid viz tryptophan, which is converted by lever in thiamin and niacin. Thiamin is a catalytic for oxidation of rice, which produces energy and support nervous system. Low tryptophan in rice supports protein deficiency. Earlier study (Yadav2015) enumerated variety of problems from food chain which create health hazard particularly for wheat and rice consumers in the Indo-Gangetic belt (Kaur and Seema, 2015) their remediation (Yadav, 2013, 2015c).

Inorder to substantiate the nutritional deficiencies in rice/khichadi brands, well known situations are referred to fortify the basis for deriving several related conclusions. Hence, inadequacy of production of data for substantiating such knowledge, in this study is overcome by well-known reports and widely experienced ailment from other studies (Audrey, *et al.* 1994, Gupta, 2000, Horobin 2003, Kaur and Seema, 2015, Yadav, 2013, 2014, 2015c). These references have well established facts and accepted data which should be taken as sufficient for substantiating results, presented in this study.

This study presented amino acid content of different food grains, which support weakness in rice. (Gupta, 2000 and Yadav, 2014). This fact sufficiently supports the situation of nutrient deficiency of khichadi. Thus, there exists widespread deficiency of protein and vitamin in all brands of Indian khichadi. Ease of cooking, time saving, addition of spices etc add flavor and taste, which become points of justification for provoking the khichadi. The audio, visual and print media had been focusing only such good aspects. The word khichadi is being used either for good or joking context. There has been not even a one report on scientific fact of food and even on khichadi. This fact reveals lack of nutritional quality of khichadi and even food science. This fact is revealed by the review and information presented in this study. In absence of such scientific background/knowledge people are not in position to foresee weakness of khichadi and likely development of bad situation for health hazard. Hence, this article is clarifying such discrepancies and create awareness to supplement food in general and khichadi in particular to take care of feel good and health care. These facts will go long way in supplementing new theme i.e. food is medicine that will help save expenditure on high cost of medicines.

Regarding enhancing sufficiency of pulse production another study (Yadav, 2017) presented innovative practice for enhancing yield of food commodities with quality viz cereal, pulses, oil seeds and making widespread shortfall of pulse production, based on management of nitrogen cycle and reduction of emission of greenhouse gas nitrous oxide (N<sub>2</sub>O), which has been declared winner of a world academic championship 2017 in chemical research. Thus, it is expected that such protein Deficienciencias get made up and per capita pulse availability will get enhanced. Thus, in time to come widespread protein deficiency in food will get eliminated.

Maize flour and sweet corn should be added in the food and suitably cooked. But Mize rich in vitamin A is to be remembered with critical content of tryptophan. Hence, it needs to find solution so that low content of tryptophan gets sufficiently absorbed by body. For this reason there should be supplement of dairy product viz milk, curd, butter milk and even butter. Tryptophan gets converted into niacin and thiamin. Conversion of niacin from week tryptophan, ie 1:50 (Table 6). B complexes viz B1 Thiamin, B2 also supplement thiamin which help overcome thiamin deficiency in khichadi. Sweet corn and green peas contain good content of thiamin and can be added in khichadi. Lycopene viz vitamin carotenoid can be supplemented by adding carrot. Vitamin A is absorbed when it is combined with vitamin C. This constituent demands that khichadi should be more watery not as a semisolid. There has been existing practice of making vegetable and addition green peas will enhance nutritional quality of food, but it will qualify to be called as vegetarian polav or

vegetarian biryani, as consistency of this preparation is drier than that of khichadi. This fact demand a strict nomenclature of khichadi viz it should be watery and biryani less watery. This implicates that there is a strict specification for cooking, ideal brand of vegetarian Khichadi of Indian taste and polao/biryani of no vegetarian viz kheema khichadi of Hyderabad, Bisi bele bath of Karnataka or other state.

Thus, sufficiency of protein, vitamin, A, vitamin B1, Vitamin B2 and lycopene, preparation with green peas, carrot, sweet corn, to-mato, with sufficient water is new recipe of ideal khichadi. Depending on taste, the spices and antioxidant can be used. As per customs of different region. Invariably the ideal watery khichadi should be eaten with curd or buttermilk or butter. This vegetable biryani can be relatively drier and can be eaten with other food supplements. These two preparations will form ideal brands of khichadi and vegetable biryani. It requires crop diversification such as production of pulses, rice, maize and sweet corn, green peas, carrot and other antioxidants and flavor adding specie. Strengthening of dairy production requires equal thrust in overcoming discrepancy that might develop due to wide spread use of khichadi. It demands a new function in public governance.

Thus, as stated the khichadi is discrepant in nutritional aspect of ideal food. It is ok for change of taste and as occasional food or Prasad, it will be dangerous if its intake is more than once in a week. Now consider yearly scenario, once a week will be  $52/365 = .14 = 14\%$ ; twice a week =  $52 \times 2 / 365 = 28\%$ ; alternate days ie 4 days a week =  $56\%$  and daily: it will be  $100\%$ .

That means, in a week daily rice and dhal eaters will have night blindness especially vegetarian family children and old gentry, if they have no access to milk or dairy product will help create such information. A survey can produce data to test this hypothesis. The suggestion provoked by honorable Yogi Aditya Nath, the Chief Minister of Uttar Pradesh is in right direction of enhancing food based health care. It will require management of fodder, water and dung, which will enhance low level employment of people. House hold dairy can be effectively promoted to fulfill the said declared objective of the Government. It is substantiated by this study the wide spread nutrient deficiency and health hazards. However, this study did not lay attempt in sorting out the toxicity in food and nutrition. Nevertheless, toxicity of arsenic in, a geographical food deficiency and toxicity (Yadav, 2014b) is broad aspect coverage of toxicity. Arsenic toxicity is coming as a major consideration for export of rice. It covered nutritional sufficiency for taking care to maintain good health and feel good in future.

## Conclusion

This study presented ways to enhance nutritional quality of khichadi and make it ideal and sufficiently good food. New bands of Khichadi rich in protein, vitamin mineral, spices, and flavor and cooked in recommended suitable consistency will save gentry from disastrous nutritionally deficient situation and grip of diseases. viz night blindness, nervous system and mental disorders, as well as 3D Diseases (dysentery, dermatitis is and dementia). There is need to understand nutritional supplementation, style of cooking and supplementary item of dairy products with khichadi. The drier consistency food viz vegetable biryani eaten with other food supplement can be dry, but same attention should be given for constituent of protein and vitamin nutrition building ingredients. Thus, nutritious khichadi and supplementary food items will come support of new theme food is medicine.

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**Citation:** RC Yadav and Iaya Yadav. "Scientific Backing of Rice Based Food Blends-Indian and Foreign Brands of Khichadi". *Nutrition and Food Toxicology* 2.2 (2017): 317-331.

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