Review Article

Comparative Proximate Nutraceutical study of Poor man's pulse, Horsegram [*Macrotyloma uniflorum*] with the other common legume crops: A Review

Abstract

Horsegram is an underutilized drought hardy crop and mainly neglected by the farmers in Northern region of India. However, the present study reveals the hidden comparative analysis of nutraceutical use with well-known legumes like *Phaseolus vulgaris, Vigna mungo, Cicer arietinum, Vicia faba, Cajanus cajan, Vigna radiata, Pisum sativum and Lens culinaris*.This pulse crop is an excellent source of carbohydrate, protein and dietary fiber. This present study shows that amount of energy in horsegram falls in the range of 376.12-377.21Kcal/100g which is maximum than the other legumes. The ash, protein, dietary fibres, carbohydrates, fat and starch content of horse gram falls in therange(2.24% to 5.16 %), (18.15% to 28.8%), (5% to 16.3%), (50% to 63.4%), (1.10 to 1.9%) and (31.86% to 47.5%)respectively. Horsegram is found to be less fat and more dietary food fibers than the most common legumes.Hence, it is an excellent source of food for diabetic patients and useful in weight management. The unique anti-uroliathiatic activity of horsegram is well known against calcium oxalate crystals, calcium phosphate crystals and uric acid crystals. Anticholelithiatic, Anti-histaminic, Hemolytic, Larvicidal, Proteinase inhibition and Anti-HIV are among other unique medicinal propertiesof horsegram which are not reported in any other legumes.

Keywords: Horsegram, Anti-HIV, Anti-uroliathiatic, calcium oxalate

Introduction

Legumes are ranked second after cereals which act as the main component of the human diet since times **(Singh and Maiti, 2016; Mishra *et al.*, 2018; Kaur and Saini, 2018; Bhadana *et al.*, 2013)** and are considered to be the most important source of food for human as well as animal **(Bhatt and Karim, 2009)**. A variety of Legumes are grown worldwide particularly*Vigna mungo*, *Vicia faba*, *Cicer arietinum*, *Phaseolus vulgaris*, *Vigna radiata*, *Pisum sativum*, *Lens culinaris* and*Cajanus cajan*etc. **(Rao, 1982).** Among all legumes, Lentil is mentioned in the cropping system of ancient Egypt and faba beans are in Bible. Legumes are used by the Romans in pastures and for soil improvement dating 37 B **(Allen and Allen, 1981).**The domestic consumption of pulses in India was 186.5 lakh tonnes and are all consumed by the peoples in various ways e.g. food **(Duranti, 2006; Khokhar and Chauhan, 1986)** because of possessing high protein content, vitamins, amino acids and pharmaceutical importance.It provides dry and green fodder for animals, producing green manure which improves soil health and adds nutrients into the soil**(Parul, 2014; Bhatt and Karim, 2009; Vietmeyer, 1986)**.Protein-energy malnutrition is a serious problem due to the increasing population, decrease of fertile land and degradation of natural resources **(Deshpande, 1992 and Steiner, 1996)**. Legumes are an excellent source of protein and are emphasized as an active substitute for animal protein **(Famurewaand Raji, 2005).**It has become a necessity in developing countries to overcome the problem of hunger and malnutrition by exploring the underutilized legumes**(Coulter *et al.*, 1988; Chel-Guerrero *et al.*,2002; Arinathan *et al.*, 2003).**Underutilized legumes are considered to be the source of dietary requirements of the rural peoples during drought and famine situations **(Magbagbeola *et al*., 2010).**

Horsegram is one of the underutilized and unexplored food legume **(Aiyer, 1990; Reddy *et al.*, 2008)** with**a** good source of carbohydrates, protein and energy **(Bravo *et al.*, 1999)**.This crop is highly adaptable to low fertility land **(Witcombe *et al*., 2008),** drought (**Bhardwaj and Yadav, 2012**), salinity (**Reddy *et al*.,1998**) and heavy metal stresses(**Reddy *et al*., 2005**). Beside all these useful benefits of horse gram, this food crop is being neglected by the farmers of Punjab in India due to the negative image attached to this crop as ‘Poor man’s food’. The main reasons for its underutilization are like forgetting its agronomic practices. However, there are numerous references existing in the traditional medicinal system of horse gram showing its medicinal consequences like anti-

diabetic(**Raj and Reddy, 2016; Parthsarthi and Sexena, 2013)**, anticalcifying**(Bijarnia*et al.*, 2009; Atodariya*et al.*, 2013)**, anti-hypercholesterolemic**(Sengupta *et al.*, 2012; Kumar*et al.*, 2013)**,analgesics**(Ashraf *et al.*, 2018; Fatima *et al.*, 2018)**, antioxidant **(Singh *et al.*, 2012; Ravishankar *et al.*, 2012)**and larvicidal properties **(Gupta *et al.*, 2011)** and hence it is all-important to investigate the comparative analysis of nutrient compositions of underutilized food legume crop horse gram with otherwell-known legumes.The present population of world is increasing at a rapid pace and hence, it is very difficult to fulfill the needs of daily energy consumption in upcoming years. The present study is useful to access the hidden value of nutraceutical components of horse gram and where it stands among the other unique well-known legumes. Each and every legume provide good amount of energy which is useful to human beings for living. The energy value in different legumes on dry weight basis (Kcal/100g) is shown in Table1.

Table 1: Energy value in different legumes on dry weight basis (Kcal/100g)

Horsegram	Kidney bean	Black gram	Chickpea	Faba bean	Pigeon pea	Mung bean	Pea	Lentil
376.12-377.21 (Jain *et al.*, 2012)	**120.35-125.45** (Hadzic *et al.*, 2013)	**211** (Maneemegalai and Nandakumar, 2011)	**347** (Woleung et al., 1968; Gopalan et al., 1980)	**320** (Woleung et al., 1968; Gopalan et al., 1980)	**301** (Woleung et al., 1968; Gopalan et al., 1980)	**310** (Woleung et al., 1968; Gopalan et al., 1980)	**93** (Das *et al.*, 1993)	**302** (Woleung et al., 1968; Gopalan et al., 1980)

The amount of energy in horsegram falls in the range of 376.12-377.21Kcal/100g **(Jania *et al.*, 2012)**followed by Chickpea(347 Kcal/100g) which is more than many other legumes and less is present in the Peais 93Kcal/100g **(Table 1)**. The amount of energy amount in different ranges in different legumes i.e. 120.35-125.45Kcal/100g in Kidney bean **(Hadzic *et al.*, 2013),**211 Kcal/100g in Black gram **(Maneemegalai and Nandakumar, 2011)**, 320 Kcal/100g in Faba bean, 301Kcal/100g in Pigeon pea, 310 Kcal/100g in Mung bean and 302 Kcal/100g in Lentil **(Woleung et al., 1968; Gopalan et al., 1980).**

Each legume is known for the presence of different nutraceutical contents that play various roles in metabolic activities of humans and animals. Each component fulfills the energy requirement of all human beings and acts as the energy fodder source for animals also.

The neutraceutical contents of most important pulses i.e. Black gram (*Vigna mungo*), Faba bean (*Vicia faba*), Chickpea (*Cicer arietinum*), Kidney bean (*Phaseolus vulgaris*), Mung bean (*Vigna radiata*), Pea (*Pisum sativum*), Lentil (*Lens culinaris*) and Horse gram (*Macrotyloma uniflorum)*vary in different concentrations with respect to ash, protein, dietary fiber, fat, carbohydrates, starch content, vitamins (Fat-soluble and water-soluble) and minerals (micronutrients and macronutrients) respectively.

Ash

The residues especially minerals are left after the substance is completely burnt called ash. These minerals are very useful in the various metabolic and biological reactions such as growth, development, flowering and reproduction etc. take place in the plant metabolic machinery as well as useful for human beings and for the environment also. Ash content of horsegram varies among all pulses shown in Table 2.

Table 2: Comparative details of Ash (%) in different legumes

Horsegram	Kidney bean	Black gram	Chickpea	Faba bean	Pigeon pea	Mung bean	Pea	Lentil
3.8	**3.67**	**3.67**	**4.2**	**3.97**	**4.02**	**3.27**	**2.74**	**5.7**
(Sudha *et al.*, 1995)	(Marquezi *et al.*, 2016)	(Kakati *et al.*, 2010)	(Yadav and Chen, 2007; Petterson *et al.*, 1997)	(Singh *et al.*, 2014)	(Akande *et al.*, 2010)	(Kakati *et al.*, 2010)	(Brenes *et al.*, 1993)	(Savage, 1988)
4.5	**4.4**	**3.1**	**3.43**	**3.6**	**5**	**3.9**	**3.52**	**2.7**
(Mandle *et al.*, 2012)	(Audu and Aremu, 2011)	(Shaheen *et al.*, 2012)	(Kinfe *et al.*, 2015)	(Elsheikh *et al.*, 1999)	(Kachare *et al.*, 2017)	(Habibullah and Shah, 2007)	(Rodrigues *et al.*, 2012)	(Khan *et al.*, 1987)
2.7	**4.47**	**3**	**3.53**	**2.81**	**4**	**2.91**	**4.1**	
(Sreerama *et al.*, 2012)	(Barampama and Simard, 1993)	(Blessing and Gregory, 2010)	(Daur *et al.*, 2008)	(Ahmed, 1997)	(Lawn and Troedson, 1990)	(Shaheen *et al.*, 2012)	(Savage and Deo, 1989)	
3.34		**3.12**	**3.2**	**3.6**	**5.8**	**2.97**	**4.08**	
(Ramteke *et al.*,					(Aparna, 2004; Pawar *et*			

2016; Ranasinghe *et al*., 2017)	(Soris *et al.*, 2010)	(Khan *et al*., 1995)	(Abdulrahim, 2004)	*al*., 2009 and Oke, 2014)	(Pasha *et al*., 2011)	(Bishnoi, 1991)
5.16	**3.47**		**3.03**	**3.8**		**4.15**
(Ravindran *et al.*, 2009)	(Modgil *et al*., 2019)		(Ali and Ahmed, 1982)	(Sharma, 2011)		(Das *et al.*, 1993)
5			**7.4**			**3.44**
(Khader and Rao, 1986)			(Tinay *et al.*, 1993)			(Pawar *et al*., 1994)
2.24			**3.6**			**4.0**
(Marimuthu and Krishnamoorthi, 2013)			(Duke, 1981)			(Alam, 2002)
			4.21			
			(Siddig, 1999)			

The ash content of horse gram falls in therange from 2.24% **(Marimuthu and Krishnamoorthi, 2013)** to 5.16 %**(Ravindran *et al.*, 2009).** Themaximum amount of ash content is 4.47% in kidney bean **(Barampama and Simard, 1993)**, 3.67 in black gram**(Kakati *et al.*, 2010)**, 4.2 in chickpea**(Yadav and Chen, 2007; Petterson *et al*., 1997)**, 7.4 in faba bean**(Tinay *et al.*, 1993)**, 5.8 in pigeon pea**(Aparna, 2004; Pawar *et al*., 2009 and Oke, 2014)**, 3.9 in mung bean**(Habibullah and Shah, 2007)**, 4.15 in pea**(Das *et al*., 1993)** and 5.7 in lentil**(Savage, 1988)** respectively. It is noticed that the ash content of horsegram is more than that of kidney bean, black gram, chickpea, mung bean and pea but it is found to be less than faba bean, pigeon pea and lentil.

Protein

The storage protein inside the various pulses acts as the biological reserve of various metal ions as well as amino acids which is later on used by the organisms or plant itself. The dry seeds of leguminous plants contain the high concentrations of storage proteins up to the amount of 25%. The variance of protein content in all the legumes is shown in Table 3.

Table 3: Comparative details of Protein (%) in different legumes

Horsegram	Kidney bean	Black gram	Chickpea	Faba bean	Pigeon pea	Mung bean	Pea	Lentil
18.15 (Ramteke *et al.*, 2016)	**25.23** (Celmeli *et al*., 2018)	**27.87** (Kakati *et al.*, 2010)	**23.40** (Alajaji and El-Adawy, 2006)	**31.31** (Singh *et al.*, 2014)	**18.8** (Saxena, 2010)	**23.96** (Kakati *et al.*, 2010)	**20.80** (Brenes *et al.*, 1993)	**35.5** (Savage, 1988)
22(Gopalan *et al.*, 1999; Kadwe *et al.*, 1974 and Pore, 1979)	**25.23** (Shelli-Dessert and Bliss, 1991)	**21.3** (Shaheen *et al.*, 2012)	**20.92** (Kinfe *et al*., 2015)	**30.1** (Tinay *et al.*, 1993)	**21.07** (Akande *et al.*, 2010)	**23.7** (Habibullah and Shah, 2007)	**24.31** (Rodrigues *et al.*, 2012)	**24.1** (Khan *et al.*, 1987)
21.45(Jogyabathi *et al.*, 2001)								
22.5(Sreerama *et al.*, 2012)	**15.3** (Audu and Aremu, 2011)	**22.51** (Arulbalachandran and Mullainathan, 2009)	**30** (Wallace et al., 2016)	**39** (Elsayed, 1994; Elsheikh *et al.*, 1999)	**18.8** (Ayenan, 2017)	**24.0** (Shital and Yeshwant, 2013)	**38.3** (Pandey and Gritton, 1975)	**31.3** (Bhatty *et al.*, 1976)
22.05(Ravindran *et al.*, 2009)								
22.57(Diwaker *et al.*, 2000)								
23.1(Begum *et al.*, 1977)	**22.26** (Barampama and Simard, 1993)	**25.1** (Jansen, 2006)	**21.27** (Daur *et al.*, 2008)	**33.69** (Dalil, 2017)	**25.45** (Kachare *et al.*, 2017)	**22.5** (Shaheen *et al.*, 2012)	**29.3** (Renu and Bhattacharya, 1989)	**36.4** (Hawtin *et al.*, 1977)
23.6(Borhade *et al.*, 1984)								
23 (Venketesh, 1999)								
24.24(Ranasinghe *et al.*, 2017)		**23.22** (Tresina and Mohan, 2011)	**31.4** (Sindhu and Sumathi, 2015)	**28.4** (Siddig, 1999)	**25** (Chaturvedi and Ali, 2002)	**31.32** (Anwar et al., 2007)	**31.0** (Black *et al.*, 1998)	
25(Khader and Rao, 1986)			**25.4**	**29.1** (Welch and Griffiths,	**23** (Lawn and Troedson,		**26.32** (Kosson *et*	

25.3(Sudha *et al.*, 1995)	(Khan *et al.*, 1995)	1984)	1990)	*al.*,1994)
26.1(Osama *et al.*, 2002)		**27.5**	**25**	**25.41**
		(Vetter, 1995)	(Sethi and Chatterjee, 1997)	(Alam, 2002)
28.8 (Patil and Deshmukh, 1985)		**30.63**	**26.38**	
		(Ahmed, 1997)	(Aparna, 2004; Pawar *et al.*, 2009; Oke, 2014 and Vasave, 2003)	
			22	
			(Sharma, 2011)	

The maximum amount of protein content is found to be 39% in faba bean**(Elsayed, 1994; Elsheikh *et al.*, 1999)**followed by38.3% in pea**(Pandey and Gritton, 1975),** 36.4% in lentil**(Hawtin *et al.*, 1977),** 31.4% in chickpea**(Sindhu and Sumathi, 2015)** and 31.32% in mung bean**(Anwar *et al.*, 2007)**respectively. The maximum protein content in horsegram is found to be 28.8% **(Patil and Deshmukh, 1985)**which is maximum than kidney bean (25.23%) **(Shelli-Dessert and Bliss, 1991; Celmeli *et al.*, 2018),** black gram (27.87%) **(Kakati *et al.*, 2010),** Pigeon pea (26.38%)**(Aparna, 2004; Pawar *et al.*, 2009; Oke, 2014 and Vasave, 2003).**

Dietary fibers

Dietary fibers play an important role in the digestive system of human beings. These fibers are present in the various cereals, fruits, seeds and vegetables contain the indigestible parts of plant's material which keep the digestive system healthy. The dietary fibers details of all these legumes are shown in Table 4.

Table 4: Comparative details of Dietary fibers (%) in different legumes

Horsegram	Kidney bean	Black gram	Chickpea	Faba bean	Pigeon pea	Mung bean	Pea	Lentil
16.3	**3.91**	**4.90**	**22.7**	**13.49**	**6.6**	**4.12**	**9.9**	**5.9**
(Sreerama *et al.*, 2012)	(Megat *et al.*, 2016)	(Kakati *et al.*, 2010)	(Yadav and Chen, 2007)	(Singh *et al.*, 2014)	(Saxena, 2010)	(Kakati *et al.*, 2010)	(Savage and Deo, 1989)	(Savage, 1988)
5.63	**3.6**	**3.0**	**16.91**	**8.08**	**7.52**	**6.8**	**7.10**	**4.7**
(Ravindran *et al.*, 2009; Ranasinghe *et al.*, 2017)	(Audu and Aremu, 2011)	(Shaheen *et al.*, 2012)	(Kinfe *et al.*, 2015)	(Abdulrahim, 2004)	(Akande *et al.*, 2010)	(Habibullah and Shah, 2007)	(Rodrigues *et al.*, 2012)	(Khan *et al.*, 1987)
12.14		**3.67**	**9.89**	**9.03**	**8.1**	**4.1**	**10.30**	
(Marimuthu and Krishnamoorthi, 2013)		(Modgil *et al.*, 2019)	(Daur *et al.*, 2008)	(Elsheikh *et al.*, 1999)	(Sinha, 1977)	(Shital and Yeshwant, 2013)	(Bishnoi, 1991)	
5		**3.2**	**11.2**		**6.6**	**2.9**	**4.49**	
(Ray, 1970)		(Alagsundaram and Kanchana, 2015)	(Khan *et al.*, 1995)		(Ayenan, 2017)	(Shaheen *et al.*, 2012)	(Das *et al.*, 1993)	
5.7					**5**	**2.2**	**8.29**	
(Rao and Sampth, 1979; Sudha *et al.*, 1995)					(Lawn and Troedson, 1990)	(Hussain *et al.*, 2010)	(Alam, 2002)	
5.3						**8.9**		
						(Agugo and Onimawo,		

(Gopalan *et al.*, 2007) 2009)

The maximum amount of dietary fibers is found to be 22.7% **(Yadav and Chen, 2007)**in chickpea followed by horsegram (16.3%) **(Sreerama *et al.*, 2012).**Horsegram is a good source of dietary fibers in human diet and noticed that it has more dietary amount food than the other legumes excluding Chickpea. Kidney bean, black gram and mung bean has minimum amount of fibers with 3.6% **(Audu and Aremu, 2011)**, 3% **(Shaheen *et al.*, 2012)** and 2.2% **(Hussain *et al.*, 2010)**respectively**.**Faba bean, pigeon pea, pea and lentil is also a good source of dietary fibers with 13.49% **(Singh *et al.*, 2014)**, 8.1% **(Sinha, 1977)**, 10.30% **(Bishnoi, 1991)** and 5.9% **(Savage, 1988)**respectively**.**

Carbohydrates

The amount of carbohydrate content, sugar, fat, and starch are also varying among all the pulses at different concentrations. This content plays an important role in seed dormancy and protects the young embryo from environmental shocks and later on nourishes it in unfavorable conditions. The details of their carbohydrate amount in different legumes are shown in Table 5.

Table 5: Comparative details of Carbohydrate (%) in different legumes

Horsegram	Kidney bean	Black gram	Chickpea	Faba bean	Pigeon pea	Mung bean	Pea	Lentil
58.32	**57.19**	**63.70**	**47.42**	**57.3**	**58.7**	**58.9**	**56.6**	**59.7**
(Marimuthu and Krishnamoorthi, 2013)	(Megat *et al*., 2016)	(Ofuya and Akhidue, 2005)	(Alajaji and El-Adawy, 2006)	(Ofuya and Akhidue, 2005)	(Ofuya and Akhidue, 2005; Sinha, 1977)	(Habibullah and Shah, 2007)	(Ofuya and Akhidue, 2005)	(Ofuya and Akhidue, 2005)
55	**63.7**	**58.73**	**56.30**	**53.58**	**60.48**	**61.2**	**74.0**	**55.0**
(Ray, 1970)	(Ofuya and	(Modgil *et al*., 2019)	(Kinfe *et al*., 2015)	(Singh *et al.*, 2014)	(Kachare *et al.*, 2017)	(Ofuya and Akhidue,	(Savage and Deo,	(Khan *et al.*, 1987)

	Akhidue, 2005)					2005)	1989)
63.4	**49**	**63.60**	**42.2**	**48.3**	**62.63**	**56.7**	
(Subba and Sampath, 1979)	(Audu and Aremu, 2011)	(Tresina and Mohan, 2011)	(Sindhu and Sumathi, 2015)	(Elsheikh *et al.*, 1999)	(Aparna, 2004; Pawar *et al.*, 2009 and Oke, 2014)	(Shital and Yeshwant, 2013)	
61			**55**	**54.8**	**65**		
(Sudha *et al.*, 1993)			(Khan *et al.*, 1995)	(Tinay *et al.*, 1993)	(Sharma, 2011)		
50				**50.8**	**58.8**		
(Jogyabathi *et al.*, 2001)				(Siddig, 1999)	(Faris and Singh, 1990)		
57.2				**48.12**			
(Gopalan *et al*., 2007)				(Abdulrahim, 2004)			

The carbohydrate content of horse gram varies from range 50**(Jogyabathi *et al.*, 2001)** to 63.4%**(Subba and Sampath, 1979).**The maximum amount was noticed in pea with 74% **(Savage and Deo, 1989)**followed by pigeon pea with 65%**(Sharma, 2011)**. Black gram and kidney bean have 63.7% carbohydrate content **(Ofuya and Akhidue, 2005).**Themaximum amount ofcarbohydrate content in chickpea, faba bean, mung bean and lentil is 56.30% **(Kinfe *et al.*, 2015)**, 57.30% **(Ofuya and Akhidue, 2005)**, 61.2% **(Ofuya and Akhidue, 2005)** and 59.7% **(Ofuya and Akhidue, 2005)** respectively.Horsegram is a good source of carbohydrate content on dry weight basis and having more amount than chickpea, faba bean, mung bean and lentil.

Fat

Plants store their energy in the form of carbohydrates, but at the time of ripening they change these oxygen rich components into carbon-rich triglycerides i.e. lipids and fat. These are both useful for the seeds at the time of germination by providing energy. The amount of fat varies in large amount in among all the pulses and the maximum amount of fat found in pea from the collected data. The details of fat in different legumes are shown in **Table 6**.

Table 6: Comparative details of Fat (%) in different legumes

Horsegram	Kidney bean	Black gram	Chickpea	Faba bean	Pigeon pea	Mung bean	Pea	Lentil
1.10	**1.33**	**1.54**	**7.42**	**1.58**	**1.9**	**1.60**	**6.1**	**3.7**
(Ranasinghe *et al.*, 2017)	(Celmeli *et al*., 2018)	(Kakati *et al.*, 2010)	(Yadav and Chen, 2007)	(Singh *et al.*, 2014)	(Saxena, 2010)	(Kakati *et al.*, 2010)	(Savage and Deo, 1989)	(Gaydou *et al.*, 1983)
1.30	**1.01**	**1.01**	**7.01**	**2.2**	**2.3**	**1.90**	**1.18**	**4.3**
(Ramteke *et al*., 2016)	(Barampama and Simard, 1993)	(Shaheen *et al.*, 2012)	(Kinfe *et al*., 2015)	(Tinay *et al.*, 1989)	(Ayenan, 2017)	(Habibullah and Shah, 2007)	(Brenes *et al*., 1993)	(Khan *et al.*, 1987)
1.4		**2.94**	**5.1**	**0.7**	**2.93**	**1.30**	**2.79**	
(Sreerama *et al.*, 2012)		(Soris *et al.*, 2010)	(Khan *et al*., 1995)	(Ali and Ahmed, 1982)	(Kachare *et al.*, 2017)	(Shital and Yeshwant, 2013)	(Bishnoi, 1991)	
1.25		**1.77**	**6.48**	**1.08**	**2**	**1.35**		
(Marimuthu and Krishnamoorthi, 2013)		(Modgil *et al*., 2019)	(Jukanti *et al*., 2012)	(Elsheikh *et al.*, 1999)	(Lawn and Troedson, 1990)	(Shaheen *et al.*, 2012)		
1.32		**1.30**	**8.83**	**1.61**	**3.1**	**1.24**		
(Worthington et al., 1972; Subba and Sampath, 1979)		(Saharan et al., 2002)	(Jukanti *et al*., 2012)	(Siddig, 1999)	(Aparna, 2004; Pawar *et al.*, 2009; Oke, 2014 and Vasave, 2003)	(Butt and Batool, 2010)		

1.9	**10.20**	**1.2**	**1.2**	**1.12**
(Osama *et al*., 2002)	(Jukanti *et al*., 2012)	(Welch and Griffiths, 1984)	(Sharma, 2011)	(Pasha *et al*., 2011)
		1.70		
		(Ahmed, 1997)		

A huge variation of fat is noticed among the legumes and it varies from a range of1.10 % **(Ranasinghe *et al.*, 2017)** to 1.9% **(Osama *et al.*, 2002).**The maximum amount of fat is noticed in chickpea with 10.20 % **(Jukanti*et al*., 2012)** followed by pea with 6.1 % **(Savage and Deo, 1989)** respectively.The fat content of horsegram is found to be less than that of black gram, chickpea, faba bean, pigeon pea, mung bean, pea and lentil with 2.94%**(Soris *et al.*, 2010),** 10.20%**(Jukanti*et al*., 2012),**2.2%**(Tinay *et al.*, 1989)**, 3.1%**(Aparna, 2004; Pawar *et al.*, 2009; Oke, 2014 and Vasave, 2003)**, 6.1%**(Savage and Deo, 1989)** and 4.3%**(Khan *et al.*, 1987)** except kidney bean and mung bean respectively.

Starch

Plants convert the carbon dioxide from the atmosphere, sunlight and water into oxygen and glucose. Glucose is stored in plant tissue for food and energy principally by photosynthesis. Starch is the reserve food material of the plant mainly composed of glucose molecules linked in long chains. The details of starch in different legumes are shown in **Table 7**.

Table 7: Comparative details of Starch (%) in different legumes

Horsegram	Kidney bean	Black gram	Chickpea	Faba bean	Pigeon pea	Mung bean	Pea	Lentil
31.86	**42.21**	**41.72**	**83.9**	**52.7**	**48.2**	**56.87**	**48.6**	52.8
(Ravindran *et al.*, 2009)	(Marquezi *et al*., 2016)	(Kakati *et al*., 2010)	(Alajaji and El-Adawy, 2006)	(Ofuya and Akhidue, 2005)	(Ofuya and Akhidue, 2005)	(Kakati *et al.*, 2010)	(Ofuya and Akhidue, 2005)	(Ofuya and Akhidue, 2005)

31.86	**56.5**	**47.9**	**56.3**	**44.16**	**53**	**53.6**	**40.31**
(Ranasinghe *et al.*, 2017)	(Ofuya and Akhidue, 2005)	(Ofuya and Akhidue, 2005)	(Yadav and Chen, 2007)	(Singh *et al.*, 2014)	(Ayenan, 2017; Saxena, 2010)	(Ofuya and Akhidue, 2005)	(Brenes *et al.*, 1993)
47.5			**50.0**		**55**		**40.95**
(Chavan *et al.*, 2013)			(Ofuya and Akhidue, 2005)		(Lawn and Troedson, 1990)		(Rodrigues *et al.*, 2012)
							46.04
							(Richter, 1976)

The starch content of horse gram varies from range 31.86**(Ravindran *et al.*, 2009)** to 47.5%**(Chavan *et al.*, 2013)**. The maximum amount of starch is noticed in chickpea with 83.9% **(Alajaji and El-Adawy, 2006)** followed by mung bean with 56.87% **(Kakati *et al.*, 2010)**, kidney bean with 56.5% **(Ofuya and Akhidue, 2005)**, pigeon pea with 55% **(Lawn and Troedson, 1990)**, lentil with 52.8%, faba bean with 52.7%, pea with 48.6% and black gram with 47.9% **(Ofuya and Akhidue, 2005)** respectively.

Pharmaceutical Importance of horsegram

According to Ayurveda, Siddha, and Unani, the various parts of the horsegram are used in medicinal use for thousands of years for various disorders**(Ranasinghe and Ediriweera, 2017).** Traditionally,It is used as a medicinal herb for amenorrhea, bile and kidney stones, conjunctivitis, piles, diabetes mellitus, dysuria**(Chunekar and Pandey, 1998).**The boiled concentrated liquor of seeds is also useful in the management of postpartum syndrome and promote the discharge of lochia **(Jayaweera, 1981).** Infusion of seeds with cow's milk is useful in the management of helminths disorders **(Kamat, 2002).** The seeds powder is consumed with curd for gastric ulcers **(Bhagwan and Kashyap, 1980).** A decoction of root is given for leucorrhoea and its plant juice provides a good cure in diarrhea **(Yadava and Vyas, 1994)**. The seeds of horsegram are used to prepare drugs such as Kulatthadi Pralepa (paste), Kulatthadi Gruta (ghee), Kulattha Yusha, Dhanyamla (sour gruel) and Dantimuladi Kwatha **(Ranasinghe and Ediriweera, 2017).**

Thepharmaceutical important properties include anti-microbial, anti-obesity, analgesic, anti-inflammatory, anti-diabetic, anti-histaminic, anti-oxidant, anti-obesity, diuretic, hemolytic, hepatoprotective, anti-diabetic and anti-hypertensive properties like the others legumes**(Kaundal *et al.*, 2019)** however this crop has many unique medicinal properties which makes it more unique than the others legumes andthese are shown in Table 8.

Table 8: List of unique pharmaceutical use of horsegram with references

Sr. No.	Pharmacological use	Plant part used	References
1	Anti-uroliathiatic against calcium oxalate crystals	Seeds	Bijarnia *et al.*, 2009
2	Anti-uroliathiatic against calcium phosphate crystals	Seeds	Kieley *et al*., 2008
s3	Anti-uroliathiatic against uric acid crystals.	Seeds	Ahmad *et al*., 1992
4	Proteinase inhibition.	Seeds	Bhartiya *et al.*, 2015
5	Anticholelithiatic activity.	Seeds	Bigoniya *et al.*, 2014
6	Larvicidal and Anorectic Activities:	Seeds	Bhuvaneshwari, 2014
7	Anti-HIV Activity:	Seeds	Gupta *et al.*, 2011

Conclusion:

Worldwide,foodinsecurityand itslowsupply cause migration of species from infertile to fertile land for the agricultural practices to overcome this limitation.Due to this, anumberofcropspeciesarebecominginexistentfromouragriculturalandforest fields,whilesomeothersarefallingbothincultivationandutilization. The production and management of food is under threat for survival due to the population explosion. If survival strategies are not created, the catastrophe will be happen in upcoming years. Aglobal food security directs re-managing crop genetic improvement and productionagronomytowardgrainlegumestoidentifyclimate-hardyspeciesvarietieswithimprovedgrainfeatures.Grainlegumesplaythesignificantrolesinthefoodculturesaroundtheworld as genuine sources of quality protein, animal fodder, natural fertilizers, natural medicineandenvironmentalrepairproducts,together withthefixed soilenrichmentpropertyofsymbiosiswithnitrogen-fixingbacteria.Legumes are the excellent source of food providing various nutraceutical elements which play the very crucial role for living. With the passage of time, some of the legumes become forgotten and underutized due to the limited knowledge of its nutraceutical importance and agricultural practices. Horsegram is usually neglected by the farmers and this present study clearly accessed that it is the richer source of nutritional and unique pharmaceutical importance like other well-known legumes. Horsegram is the richer source of energy, dietary fiber and protein like the other legumes. It contains less fat and starch which is the most useful food for diabetic patients. Its pharmaceutical use like anti-uroliathiatic activity against calcium oxalate crystals, calcium phosphate crystals and uric acid crystals makes it more unique than the other legumes. This crop is also a drought hardy crop and capable to live in water deficit areas. These all properties of horsegram is capable to decrease the problem of food

insecurity reflecting whole economy of the country and prevent us from many medical problems.In order to meet the global food demands, focus should be on promoting the cultivation and utilization of this crop by agricultural researchers, plant breeders,extension services,donors, technology providers, policyand decision-makers, as well as consumers which has been neglected and underexploited but have the potential to enhance food and nutrition security especially in India

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