

## Effect of Storage on Selected Cowpea Varieties.



### Home Science

**KEYWORDS :** Cowpea, Dhal. Physical Characters, Moisture, Reducing Sugar, Lysine and Methionine

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### ABSTRACT

*A Study was conducted to evaluate the quality characteristics of cowpea varieties both gram and dhal packed in glass bottles and in polyethylene bags with and without vacuum. The physical characteristics like length, breadth, thickness, bulk density and 100 grain weight was studied. The moisture content reduced gradually during storage for both whole gram and dhal packed in different packaging materials. The highest protein content was found in variety p152, (24.85) and lowest in variety vcp 8. The protein was found higher in the cowpea dhal samples than the whole gram. During storage as light change in the protein content was found in all the varieties and in all treatments. The amino acids lysine and methionine content had slightly reduced during storage in both whole gram and dhal cowpea sample. The reducing sugar showed an increasing trend in all varieties during storage. After 180 days of storage the variety co 4 stored in polyethylene bag with vacuum had maximum reducing sugar for whole gram and the variety vcp8 stored in glass bottle had maximum reducing sugar for dhal. The total sugar content for dhal reduced during storage. Whole gram cowpea samples had slightly higher total sugar content than the dhal samples. The reducing sugar showed an increasing trend in all varieties during storage. After 180 days of storage the variety co4 stored in polyethylene bag with vacuum had maximum reducing sugar for whole gram and the variety vcp8 stored in glass bottle had maximum reducing sugar for dhal. The total sugar content for dhal reduced during storage. Whole gram cowpea samples had slightly higher total sugar content than the dhal sample.*

### Introduction

Legumes are excellent source of protein. More than 300 species of pulses are grown in India. Among these red gram, green gram, black gram, Bengal gram lentil, peas and beans are commonly used in households and commercial preparations whereas, horse gram, lab-lab and cowpea are used in very limited quantum in in the house hold. In spite of having such an extra ordinary quality the area of production and the productivity of pulses remained stagnated.

**Singh (1970)** had said that since 1950 the production of pulses has been increased by only 0.3% . The per capita availability of pulses has decreased from 60 to 36.5 gm/day. The dish balanced in the proportionate increase in the production of food grains scenario brought up the protein –calorie deficiency in the rapidly growing population. The remedy to this problem is to increase not only the production of common pulses but also the less used pulses. Cowpea commonly known as 'labia', an ancient Neolithic African crop is now grown thought the tropics and sub tropics as a pulse, a vegetable, a fodder and as a cover crop. Cowpea grain contains 23.4 protein, 1.8 fat ,60.3 carbohydrate g/100gm. The amino acids pattern of cowpea is closure to that of whole egg, but it is deficient in methionine cysteine (**Eusebio and Mamari, 1968**). **Gopalan et al (1989)** estimated the composition of cowpea and reported as 24.1 protein ,1.0 fat ,3.8 fiber and 54.5 carbohydrate gm/100 gm. The amino acids constituent of cowpea was noted as lysine 430, tryptophan 310, phenylalanine 320, tyrosine 230, methionine 0.90, cysteine 0.80, threonine 230, lysine 480 and iso lysine 270 mg /gm N. The vitamin and inorganic contents of cowpea was recorded as 0.51, 0.20, 0.77, 414 and 8.6 mg for B1, B2, Ca, P and Fe respectively.

### Materials and Methods

Four cowpea varieties namely P 152, CO4 ,CO6 and VCP 8 selected for this study were purchased from the National pulse research station. Tamil Nadu Agricultural University, Vamban, Tamil Nadu. All the selected samples were dried for five hours in the sun, cleaned and stored in the aluminum containers. The cowpea varieties (whole gram and dhal selected for the study is shown in plate 1 and 2. Glass bottles of 500 gm capacity and polythene bags of 250 gauge (13x9 cm) were used for storing the whole gram and dhal for the study. Equipments used in the study. Bosch balance, torsion balance, hot air oven, Klett-sumerson photo electric calorimeter, vacuum pump, sealing machine, mixer.

### Physical characteristics of cowpea

The cowpea varieties produced were cleaned manually to remove foreign matter such as stones and cal particles, shriveled, discolored and infected grains. The physical parameters were studied to evaluate the quality of each variety of cowpea (whole /dhal) viz., length, breadth, and thickness and 100 grains weight and bulk density. The Length was estimated by the method described by **Khan and Ali (1985)**. Ten uniform size cowpea (whole/dhal) was kept breadth wise on a graph paper and the mean Length was calculated and expressed in cm. The breadth was estimated by the method described by **Khan and Ali (1985)**. Ten uniform size cowpea (whole/dhal) was kept breadth wise on a graph paper and the mean breadth was calculated and expressed in cm. The thickness of each cowpea (whole /dhal) was estimated by taking the diameter of the centre portion with the help of screw gauge in express in cm. The hundred grains were randomly selected from each cowpea variety (whole /dhal) and its weight was noted and express in gram. The bulk density was done by the method described by **Ranganna (1977)**. The bulk density indicated the weight of substance held in a unit volume. The tare weight of glass cylinder (100 ml cap) was noted. The sample was filled in the glass cylinder up to the rim and the excess sample was strike off and then the weight was taken. For accurate weighing the cylinder was repeatedly tapped and re-filled.

**Table 1. Physical Characteristics of cowpea varieties (whole gram and dhal)**

Characteristics	Whole gram (w)				Dhal (D)			
	P152 (W <sub>1</sub> )	Co4 (CW <sub>2</sub> )	Co6 (CW <sub>3</sub> )	VCP 8 (CW <sub>4</sub> )	P152 (CD <sub>1</sub> )	CO4 (CD <sub>2</sub> )	CO6 (CD <sub>3</sub> )	VCP 8 (CD <sub>4</sub> )
Length (cm)	0.71	0.94	0.78	0.84	0.68	0.88	0.64	0.88
Breadth (cm)	0.68	0.71	0.49	0.78	0.48	0.46	0.55	0.56
Thickness (mm)	4.64	4.63	4.62	4.0	2.50	2.62	2.40	2.61
Bulk density	1.06	1.07	1.06	1.05	1.5	1.05	1.05	1.51
100 grain weight (g)	12.5	10.75	9.30	13.70	5.05	8.25	4.45	8.05

### Chemical analysis.

About 25 gm cowpea sample was weighed, powdered and used for various chemical analysis. The sample was freshly powdered and used for the analysis. The analysis was done in 60 days, for moisture, protein, reducing sugar, total sugar and amino acids (lysine and methionine). These analysis were done for each variety for each form and each treatment in duplicate. The moisture content of the cowpea sample was estimated by the

hot air oven drying method. The sample was dried at 130 degree celcius for one hour as described Pingale (1976). The moisture content was expressed as gram /100 gm.

**Protein:** The true protein content of the cowpea sample was estimated as per the method described by Lowry et al ( 1951). The principle for the estimation of protein was based on the development of the blue color by the hydroxyl groups present in the amino acids with the Folin-ciocalteau phenol reagent .For the preparation of sample solution ,a known amount of the powdered cowpea sample was mixed with potassium hydroxide (0.1N) solution and was made up to a known volume. The filter solution was used for the estimation of protein .A mixture of 2.0 %sodium carbonate in 0.1 N sodium hydroxide and 0.5% potassium tartrate was added followed by 0.5 ml of folly phenol reagent and mixed. The blue colored developed was read in klett summer son photo electric calorie meter( model 800-3) after 30 min using a red filter (650 nm). The true protein content of the sample was expressed as gram /100gm.The quantitative estimation of the individual amino acids lysine and methionine was done b the paper gramatography method as described by Block et.al (1956). The lysine and methionine the spots were eluted in a mixture of ethanol and 1.0% copper sculpted (80:20 v/v ). Elution time was 30 to 60 min and the quantity of the elution used was 6.02 to 8.0 ml. Absorbance of the elute was measured at 550 nm using green filter In a Klett summerson photo electric calorie meter .The lysine and methionine content was calculated and expressed as mg /100 gm of the sample. The reducing sugar content of the cowpea sample was estimated by Shaffer-somgyi method as described by Ranaganna(1977).for the estimation,5gm of the sample was accurately weighed ,and ground with distilled water boiled ,cooled was made up to 250 ml with distilled water .The aliquot of filtrate was clarified using lead acetate solution and delayed with potassium oxalate . The reducing sugar content of the sample was determined by audiometric titration of reduced cuprous oxide. For the estimating the total sugar, aliquate hydrolyzed using 1 N hydro choric acid for 2 h. After neutralization, the total sugar present in the sample was estimated the total sugar and reducing sugar were expressed as gm / 100g of the sample.

**Results and Discussion**

Four cowpea varieties (whole gram and dhal) were packed in

glass bottles and polythene bags with and without vacuum and stored at room temperature to study their chemical composition, were also analyzed. The data obtained during the stud are presented and discussed in this chapter. The physical characteristic such as length, breadth, thickness, bulk density and 100 grain weight whole gram and dhal of cowpea varieties selected for the steady are represented in table 2.The variation in the physical parameters were noted between varies and between whole gram (W) and dhal (D ).The cowpea varieties selected for the studies and the code given for each variety (whole gram and dhal) are as follows :P152(CW1 and CD1). CO4( CW2 and CD2) CO6 (CW3 and CD3) and VCP8 (CW4 and CD4) . For all discussion the code words given in the parenthesis are used throughout the text. The length of the whole gram and dhal ranged between 0.71 (cw1) and 0.9 (CW2) AND 0.64 (CD3) and 0.88 (CD2 and CD4) cm respectively.

Among the varieties the highest breadth was noted in the whole gram (0.78 cm) and the dhal (0.56 cm) of VCP 8 cowpea variety and the lowest breadth was recorded in CO6 (CW3) variety for whole gram and CO4 (CD4) for dhal. The variety VCP8 (CW4 ) had the lowest thickness for whole gram (4.0mm) and the variety CO6 (CD3)recorded the lowest thickness for dhal ( 2.4mm). The rest of the varieties whole gram and dhal more or less equal thickness. The bulk density of the selected varieties ranged between 1.05 and 1.07 and 1.05 and 1.51 for whole gram and dhal respectively.

**Changes in the chemical composition of cowpea varieties.**

**Moisture**

The changes noted in the moisture content of cowpea samples selected for the study during storage are given in table 2. The initial moisture content of the cowpea varieties ranged between 13.80and13085 and 13.25 and 13.65gm % for whole gram and dhal respectively. The whole gram samples of cowpea showed a gradual reduction in the moisture content throughout the storage period in all the treated samples. The final moisture content of the samples packed in glass bottles (T1) ranged from 12.55 to 12.70 gm %. The corresponding values for T2 ranged from 12.55 and 12.75 and for T3 ranged from 12.35 to 12.75 gm %. The corresponding values for T2 ranged between 12.55 and 12.75 and for T3 ranged from 12.35 to 12.75 g percent.

**Table 2. Changes in the moisture content (g per cent) of cowpea wholegram and dhal during storage**

Storage days	Glass bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>
0	13.85	13.80	13.80	13.85	13.85	13.80	13.80	13.85	13.85	13.80	13.80	13.85
60	13.55	13.65	13.60	13.55	13.70	13.75	13.65	13.60	13.55	13.60	13.65	13.55
120	13.05	13.05	13.15	13.10	13.25	13.25	13.40	13.50	13.15	13.25	13.10	13.15
180	12.70	12.60	12.70	12.55	12.60	12.70	12.55	12.75	12.75	12.50	12.45	12.35
Storage days	Glass Bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags without vacuum (T <sub>3</sub> )			
	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>
0	13.25	13.65	13.45	13.35	13.25	13.65	13.45	13.35	13.25	13.65	13.45	13.35
60	13.15	13.35	13.25	13.20	13.15	13.55	13.35	13.10	13.15	13.65	13.35	13.30
120	13.05	13.05	13.05	13.10	13.05	13.35	13.20	13.0	13.05	13.15	13.05	13.10
180	12.65	12.55	12.45	12.55	12.65	12.70	12.35	12.65	12.50	12.35	12.45	12.25

**Protein**

The changes observed in the protein content of cowpea varieties (whole gram and dhal) are presented in tables 3. The initial protein content of cowpea samples ranged between 24.60 (CW4) and 2.85 (CW1) for whole gram and ranged from 25.45(CD3) to 25.75 gm % for dhal (CD1 and CD4). The protein values were found to be higher in the cowpea dhal samples than in the whole gram. A slight change in the protein content during storage was noted in all the varieties and in all the treatments (whole gram and dhal). The actual % decrease in protein content of whole gram after 180 days of storage was noted as 0.60 to 0.40, 0.45 to 0.35 and 0.60 to 0.30 for T1 , T2 , and T3 respectively.

**Table 3. Changes in the protein content (g per cent) of cowpea(whole gram and dhal) during storage**

Storage days	Glass Bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>
0	13.25	13.65	13.45	13.35	13.25	13.65	13.45	13.35	13.25	13.65	13.45	13.35
60	13.15	13.35	13.25	13.20	13.15	13.55	13.35	13.10	13.15	13.65	13.35	13.30
120	13.05	13.05	13.05	13.10	13.05	13.35	13.20	13.0	13.05	13.15	13.05	13.10
180	12.65	12.55	12.45	12.55	12.65	12.70	12.35	12.65	12.50	12.35	12.45	12.25
Storage days	Glass Bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>
0	25.75	25.65	25.45	25.75	25.75	25.65	25.45	25.75	25.75	25.65	25.45	25.75
60	25.55	25.55	25.20	25.40	25.55	25.45	25.35	25.40	25.55	25.45	25.30	25.40
120	25.45	25.40	25.35	25.30	25.45	25.35	25.25	25.30	25.45	25.35	25.20	25.30
180	25.35	25.35	25.15	25.45	25.45	25.25	25.15	25.45	25.25	25.25	25.15	25.25

**Lysine**

the lysine content of the cow pea varieties (whole gram and dhal) are given in tables 4. The initial lysine content are cw1,cw2,cw3 and cw4 were noted as 1651.5,1651.5,1655.0 and 1656.5 mg/100 g respectively. The corresponding values for cd1, cd2, cd3 and cd4 were observed as 1591.0, 1592.5, 1593.0 and 1595.5 mg /100 g. a slight reduction in the lysine content for

each variety, for each form and for each treatment was noted at the end of the storage period (180 days). The final lysine content of cowpea sample( whole gram) ranged between 1651.0 and 1654.8 for T2 and 1650.0 to 1653.5 mg/100g for T3. The corresponding values for the cowpea dhal samples ranged from 1590.0 to 1594.0 for T2 and from 1590.0 to 1594.5 mg/100g for T3.

**Table 4. Changes in the lysine content (mg/100g) of cowpea wholegram and dhal during storage**

Storage days	Glass bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>
0	1651.5	1651.5	1655.0	1656.5	1656.5	1656.5	1655.0	1656.5	1651.5	1651.5	1655.0	1656.5
60	1651.0	1651.0	1655.0	1650.5	1650.5	1650.5	1655.0	1655.5	1651.5	1650.5	1655.0	1656.0
120	1651.0	1651.0	1655.0	1650.0	1650.0	1650.0	1655.0	1654.5	1650.0	1650.0	1654.5	1655.5
180	1651.0	1651.0	1655.0	1650.0	1650.0	1650.0	1654.8	1653.0	1650.5	1650.0	1653.5	1654.5
Storage days	Glass Bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>
0	1591.0	1592.5	1593.0	1595.5	1591.0	1592.5	1593.0	1595.5	1591.0	1592.5	1593.0	1595.5
60	1590.5	1591.5	1592.5	1594.5	1590.5	1592.0	1593.0	1594.5	1591.0	1591.0	1593.0	1595.0
120	1590.5	1591.0	1591.5	1593.5	1590.0	1592.0	1592.5	1594.0	1591.0	1590.5	1592.5	1595.0
180	1590.5	1591.0	1591.5	1592.5	1590.0	1591.5	1592.5	1594.0	1591.0	1590.0	1592.0	1594.5

**Methionine**

The methionine content of the cowpea samples (w and D) selected for the study are presented in tables 5. The initial methionine content of whole gram cowpea varieties ranged from 346.85 (CD4) for the dhal samples ranged between 336.69 (CD4) and 336.0 mg per 100 g (CD1). The changes in the methionine content of whole gram samples noted during storage was not remarkable whereas, in the case of dhal samples variations in the

methionine content was observed between treatments and varieties.

The final methionine content of whole gram cowpea samples for T1,T2 and T3 were recorded as 345.20-346.65, 345.85-347.40 and 346.00 – 348.00 mg/100 g respectively. The corresponding values for dhal samples were 336.60-338.0, 336.0,-0-38.0 mg/100g for t1,t2 and t3 respectively.

**Table 5. Changes in the methionine content (mg/100g) of cowpea wholegram and dhal during storage**

Storage days	Glass bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>
0	347.65	348.35	347.35	346.85	347.65	348.35	347.35	346.85	347.65	348.85	347.35	346.85
60	346.70	347.30	346.75	346.75	346.75	347.55	347.10	346.75	347.55	348.35	347.00	346.25
120	346.20	346.70	346.75	346.30	346.65	347.50	346.00	346.75	347.45	348.00	347.00	346.00
180	345.20	346.20	346.65	346.25	346.55	347.40	345.85	346.60	347.35	348.00	347.00	346.00

Storage days	Glass Bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>
0	339.0	337.65	338.20	336.69	339.00	337.65	338.20	336.69	339.00	337.65	338.20	336.69
60	338.49	337.16	338.10	336.69	339.00	337.00	338.00	336.69	339.00	337.00	338.00	336.69
120	337.45	337.10	338.10	336.60	338.61	337.00	338.00	336.20	338.40	337.00	338.00	336.00
180	336.94	337.10	338.00	336.60	338.60	336.70	337.70	336.00	338.00	336.80	337.50	336.00

**Reducing sugar**

The changes observed in the reducing sugar content of cowpea samples (w and D) during storage are given in Table6. An increasing trend in the reducing sugar content was noted in all the varieties and treatments at different storage intervals of whole gram and dhal. The reducing sugar content exhibited a variation between whole gram and dhal of each variety. The initial reducing sugar content of whole gram cowpea sam-

ples were 0.73(CW1), 0.75 (CW2),0.73(CW3) and 0.77(CW4) g per 100g. The corresponding values for the cowpea dhal sample were (CD1), 0.65(CD2), 0.65 (CD3) and 0.67 (CD4) g per 100g.

After 80 days of storage the reducing sugar content of whole gram samples were ranged from 0.96 to 0.99 g/for T1, T2 and T3. In the case of cowpea dhal samples, the reducing sugar reducing sugar content ranged from 0.85 to 0.89 g/100g.

**Table 6.Changes in the reducing sugar (mg/100g) of cowpea (g per cent) wholegram and dhal during storage**

Storage days	Glass bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>
0	0.73	0.75	0.73	0.77	0.73	0.75	0.73	0.77	0.73	0.75	0.73	0.77
60	0.84	0.86	0.87	0.88	0.82	0.85	0.85	0.87	0.85	0.85	0.85	0.82
120	0.93	0.97	0.95	0.95	0.92	0.94	0.96	0.98	0.95	0.92	0.94	0.96
180	0.97	0.98	0.97	0.98	0.96	0.98	0.97	0.99	0.96	0.99	0.96	0.98

  

Storage days	Glass Bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>
0	0.68	0.65	0.62	0.67	0.68	0.65	0.62	0.67	0.68	0.65	0.62	0.67
60	0.72	0.75	0.75	0.75	0.73	0.73	0.75	0.75	0.73	0.73	0.75	0.75
120	0.84	0.86	0.82	0.87	0.82	0.82	0.82	0.85	0.82	0.85	0.82	0.85
180	0.88	0.88	0.87	0.89	0.86	0.87	0.85	0.87	0.86	0.86	0.87	0.88

The statistical analysis of the data revealed that the reducing sugar content of cowpea samples (W and D) showed a significant difference between varieties, treatments and storage periods.

**Arora and Das (1976)** analyzed the reducing sugar content of 22 promising strains of cowpeas and reported the value as 1.55 to 4.05 percent.

After 9 months of storage, the reducing sugar content of green gram changed from 0.61 to 0.95 g/100 g (DWB) (**Vennila, 1992**).

**Total Sugar**

The reduction in the total sugar content of cowpea varieties for whole gram and dhal are presented in table 7. A gradual reduc-

tion in the total sugar content of the cowpea samples was observed throughout the storage periods in all the varieties and treatments .Whole gram samples selected for the study had slightly higher total sugar content than the dhal samples. The initial total sugar content of cowpea samples ranged between 15.14 and 15.32 for whole gram samples and 14.60 and 1.7 g per cent for dhal. After 180 days of storage the total sugar content of TICW1,TICW2 ,TICW3 and TICW4 were noted as 12.74,12.62,12.5 and 12.34 g per cent respectively. The corresponding values for T2 and T3 were noted as 12.92,12.86,12.74 and 12.62 and 12.92,12.82,12.74 and 12.62 g per cent respectively for CW1,CW2,CW3 and CW4.The final total sugar content of cowpea dhal samples ranged between 11.54 and 11.86 for T,T2 and T3.

**Table 7.Changes in the total sugar content (g per cent t) of cowpea wholegram and dhal during storage**

Storage days	Glass bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>	CW <sub>1</sub>	CW <sub>2</sub>	CW <sub>3</sub>	CW <sub>4</sub>
0	15.32	15.14	15.30	15.30	15.32	15.14	15.30	15.30	15.32	15.14	15.30	15.30
60	14.72	14.74	14.66	14.64	14.74	14.60	14.66	14.66	14.74	14.66	14.60	14.74
120	13.74	13.54	13.50	13.54	13.62	13.54	13.26	13.34	13.74	13.62	13.50	13.72
180	12.74	12.62	12.54	12.34	12.92	12.86	12.74	12.62	12.92	12.82	12.74	12.62

  

Storage days	Glass Bottles (T <sub>1</sub> )				Polyethylene bags without vacuum (T <sub>2</sub> )				Polyethylene bags with vacuum (T <sub>3</sub> )			
	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>	CD <sub>1</sub>	CD <sub>2</sub>	CD <sub>3</sub>	CD <sub>4</sub>
0	14.66	14.74	14.66		14.60	14.66	14.74	14.66	14.66	14.74	14.66	14.60
60	13.50	13.40	13.50		13.56	13.74	13.54	13.74	13.54	13.74	13.62	13.26
120	12.54	12.34	12.34		12.74	12.92	12.86	12.74	12.62	12.74	12.62	12.44
180	11.66	11.54	11.86		11.78	11.86	11.72	11.54	11.82	11.86	11.78	11.54

### Conclusion

Investigations were carried out by using cowpea of different varieties. The cowpea samples whole gram and dhal were stored in different packaging materials to study their chemical changes. Storage of cowpea under vacuum packaging had a significant effect on quality retention. The changes in moisture, protein, aminoacids (lysein and methionine ), reducing and total sugar were noted storage in all the cowpea varieties packed in T1,T2 and T3. The highest protein content was found in variety p152,(24.85) and lowest in variet vcp 8 .The total sugar content for dhal reduced during storage. The amino acids lysine and methionine content had slightly reduced during storage in both whole gram and dhal cowpea sample. The reducing sugar showed an increasing trend in all varieties during storage.

### REFERENCE

- 1.Arora ,S.K.and Das ,B.1976. Cowpea as a potential crop for starch, strake, 28:158-160.
- 2.Block ,R.J., A.B.Weiss, H.A.Almquist and B.C.Diana.1956. Aminoacid hand book ,Methods and results of protein analysis, Charles C.Thomas publishers,U.S.A.
- 3.Elsebio and Mamari.1968 Modern techniques of raising field crops. Pulse crops. Oxford and IBH publishing co.p.237.
- 4.Gopalan ,C.,B.V.Ramasastri and S.C.Balasubramanian 1989 .Nutritive values of Indian Foods,NIN,Hydrabad.
- 5.Khan MS and ch.A.Ali.1985.Cooking quality of some rice varieties J.Agric.Res.23(3):230-233.
- 6.Lowry ,O.H.,N.J.Rosen Brought,A.L.Fan,and R.J.Rand hall,1951. Protein measurement with folin .phenol reagent,J.Biochem.,193:265-273.
- 7.Pingale S.V.,1976.Handling and storage of food grains,ICAR,printed in India,New Delhi.p.12:55
- 8.Ranganna,S.1977.Mannual of analysys of fruit and vegetable products.Tata McGraw-Hill publishing company Ltd., New Delhi,pp.13-13,172-185.
- 9.Singh,V.K., and N.P.Sing ,Ed Dr.SH Dwivedi,1970 Agri situation in India Aug 1992 .Indian formers Digest.,28(9):150.
- 10.Vennila, P.1992 Studies on the use of indigenous grain portents during storage of raw rice and greengram.PHD thesis.Fd.Sci. Nutr.,submitted to TNAU.