# Changes in Protein, Carbohydrate and lipid content of cashew kernels during storage under two humidity conditions

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## Abstract

The changes occuring to cashew kernels during storage at two humidity levels - 80% to 20% with respect to organoleptic characteristics, protein content, carbohydrate content, oil content, iodine and peroxide values were studied. From the present study it is concluded that organoleptic characteristics of cashew kernels deteriorates with increase in humidity. Decrease in protein and carbohydrate content of stored cashew kernel is dependent on humidity. Humidity increased oxidative rancidification.

## Introduction

Cashew kernels are valuable as dessert nuts and are used in the production of confectionery, sweet meats, cashew butter and local tropical dishes (1). The kernel quality, however, deteriorates rapidly upon exposure of kernels to air and moisture. Normally, the shelf life of cashew kernels is extended by sealing in packets filled with an inert gas like nitrogen or carbon dioxide.

Cashew kernels are prone to oxidative changes during its distribution and storage because of its high fat content (47%). The effect of moisture in the product and the presence of oxygen in the container on the keeping quality of fatty foods have been studied (2). The influence of water activity on the rate of oxygen uptake of dried foods and on model systems have also been studied (3).

Environmental factors like temperature, moisture, light , gaseous composition and pressure of the storage atmosphere influence change in lipid, protein and carbohydrate content of stored seeds (4). High moisture facilitates degradation of oils by enzymes such as lipase which produces free fatty acids and lipozygenase which in turn produces undesirable flavours in both oils and meals. Similarly amylase, protease etc. present in the seeds are responsible for the degradation of carbohydrate and protein respectively.

The present study aims at determining the changes in protein content, lipid content and carbohydrate content during storage at two humidity levels-low (20%) and high (80%).

## Materials and methods

Export quality, plain, cashew kernels sealed in packets flushed with carbon dioxide were used. The moisture content of these kernels were found to be 4.8%. The moisture content of the kernels stored for 20 days in 20% and 80% humidity was compared to fresh kernels.

Oil was extracted in a soxhlet apparatus, using petroleum ether (40°C-60°C) as a solvent. The percentage weight of oil was determined by the method outlined by Sadasivum and Manikyam (5).

The iodine value of extracted kernel oil was determined using standard AOAC method (6) and peroxide value was determined by Cox method (7).

Defatted kernels were used for estimation of protein and carbohydrate. Lowry's method (8) was used to estimate protein content and carbohydrate was estimated by anthrone / sulphuric acid method (5).

## Results and discussion

*Changes in organoleptic characteristics*

Organoleptic characters deteriorated with increase in humidity as evident from Table - 1 increased humidity is known to foster mold growth. For instance, it has been reported that roasted cashew kernels having increased moisture content of 11.1% developed mold growth within a very short time period of 10 days (9). Raw cashew kernels are found to imbibe moisture depending on the ambient humidity conditions (Table -2). Four fold rise in humidity conditions resulted in two fold increase in moisture absorption.

*Effect of humidity on protein and carbohydrate content of stored cashew kernels.*

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The carbohydrate and protein content was found to decrease with increase in humidity as evident from Table - 3 . Presence of moisture in food stuffs has been reported to cause a decrease in the concentration of nutrients (10). The rapid growth of microorganisms which results from high moisture content also brings about decrease in concentration of protein, carbohydrate etc. (11). In the present study the increased mold growth observed in high humidity may have contributed to the decrease in protein and carbohydrate content of kernels. Another reason could be increase in activity of enzymes like protease, amylase etc.

*Effect of humidity on oil content, Iodine value and peroxide value of cashew kernels.*

The oil content was found to decrease with time in cashew kernels stored under both humidity conditions. The decrease in oil content may be due to lipase and lipoxygenase activity. The former degrades fat into fatty acids and glycerols. The latter oxidizes polyunsaturated compounds and produces obnoxious odour (4). The moisture content was reported to increase the above enzyme activities (12) and therefore influence rancidification.

The iodine value of cashew kernel oil decreased with increase in humidity, indicating an increase in oxidative rancidification, concomitant with increase in humidity. It has been proposed in earlier studies that susceptibility of fats to oxidative changes is proportional to the degree of unsaturation of fatty acids in the fat (13). As cashew kernels have high amount of unsaturated fat (82%), the decrease of iodine value may be attributed to a decrease in the unsaturated fatty acid content due to oxidation. The iodine value did not change significantly after the first 20 days, indicating that the unsaturated bonds on fatty acids which are easily oxidisable have already undergone oxidation and the remaining ones take longer time to get oxidized.

Peroxide value was reported to be dependent on initial moisture content (9). The peroxide value was zero in the present study, which indicate that, the fatty acids in rancid kernels had undergone partial autoxidation resulting in the polymerization of resultant products, without the formation of peroxides.

There are earlier reports which state that peroxidation will be low in raw peanuts stored over 5 months compared to roasted peanuts (4). (In the present study roasted kernels

**Table -1.** Organoleptic characteristics of kernels stored under low and high humidities

| Humidity level | Time in days | Colour and appearance | Texture | Mold growth |
|---|---|---|---|---|
| 20% | 7 | Watersoaked | Rubbery | Nil |
| | 30 | -do- | -do- | Nil |
| 80% | 3 | No change | -do- | Nil |
| | 4. | Water soaked | -do- | Nil |
| | 17 | Slight brown | -do- | Nil |
| | 24 | Increased browning | -do- | Nil |
| | 30 | Maximum browning | -do- | Nil |

**Table -2.** Estimation of moisture content in cashew kernels stored under different humidity conditions.

| Treatment | Initial weight | Final weight | Moisture content* |
|---|---|---|---|
| Fresh kernels | 1.8693 | 1.7781 | 4.8788 |
| Kernels under 20% humidity (20 days) | 1.9870 | 1.8983 | 4.4640 |
| Kernels under 20% humidity (20 days) | 2.0152 | 1.8237 | 9.5375 |

*% of moisture content = $\frac{\text{Initial weight - Final Weight x 100}}{\text{Internal Weight}}$

**Table -3.** Protein, carbohydrate and lipid content of cashew kernels after 20 and 40 days of storage in different humidity conditions

| Treatment. | Time in days | Protein (mg) /g. kernel | Total Carbohydrate (mg) / g. kernel | Lipid g / 100 g. kernel |
|---|---|---|---|---|
| Fresh kernel | 0 | 157.5 | 101 | 46.4 |
| Kernels kept under 20% Humidity | 20 | 135.5 | 90.5 | 42.01 |
| | 40 | 137 | 92.75 | 39.41 |
| Kernels kept Under 80% Humidity | 20 | 107 | 84.25 | 44.88 |
| | 40 | 110.25 | 85 | 42.00 |

**Table -4.** Effect of humidity on rancidification of cashew kernels

| Treatment. | Time | Iodine value | Peroxide value |
|---|---|---|---|
| Fresh kernel | 0 day | 84.2060 | Nil |
| 20% humidity | 20 days | 81.1539 | Nil |
| | 40 days | 81.0118 | Nil |
| 80% humidity | 20 days | 78.510 | Nil |
| | 40 days | 78.4241 | Nil |

developed a peroxide value of 7.8 milliequivalents / kg of fat).

The present study thus indicates that decrease in lipid content, protein content and carbohydrate content of raw cashew kernels is significantly affected by the ambient humidity during storage. Also, oxidative rancidification was also affected by humidity.

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