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Effect of fungal infection on proximate nutrient composition of coconut (*Cocos nucifera* Linn) fruit

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Abstract

The effect of fungal infection on the proximate nutrient composition of coconut fruit (*Cocos nucifera*) was studied under laboratory conditions. Proximate analysis of healthy and infected samples showed that the protein and fat were higher in the infected coconut than in the healthy fruit, while carbohydrate (17.75% healthy, 10.62% infected) and crude fibre (13.13% healthy, 10.01% infected) contents were lower in the infected fruit. There was no significant difference in the ash (1.19% infected and 1.66% healthy) content of the samples. However moisture content of healthy fruit (36.44%) was higher than that of the infected fruit (10.39%). Fungi such as *Aspergillus flavus, A. niger, A. fumigatus, Fusarium oxysporium, Mucor mucedo, M. racemosus* and *Neurospora sitophila* were frequently encountered on infected fruit. These fungi grew better on coconut extract potato dextrose agar than did on potato dextrose agar.

Key words: *Cocos nucifera*, fungal infection, nutrient content.

Introduction

Coconut (*Cocos nucifera* Linn; Family *Palmae*) is one of the most extensively grown and used nuts in the world and is rated as one of the most important of all palms[11]. Out of the 100 products that are made directly or indirectly from coconuts, eight are important in world trade. These are whole coconut, copra, coconut oil, coconut oil cake, coir, desiccated shredded coconut, coconut skim milk and coconut protein. Coconut can also be used to produce desired texture in cookies, candies, cakes, pies, salads and desserts. Coconut includes about 20% inedible shell and 72% edible portion. It contains 0.15 mg of thiamin, 1mg of ascorbic acid, traces of Vitamin A and 0.2 mg of tocopherol per 100 g sample [8]. Coconut proteins are high in nutritive value and are fairly rich in lysine, methionine and tryptophan. The percentage of alanine, arginine, cystine and serine in the protein are higher than those in cow's milk. Hence, coconut water is used for infant feeding. Due to high content of saline and albumin, it is said to check cholera, destroy intestinal warms and relieve stomach troubles.

In addition, coconut water has been found to speed up growth of *Mycobacterium tuberculosis*. For instance, the 20 days normally required for maximum growth of this organism has been reduced to 12 days when coconut water was added to the culture medium, even when diluted 10 fold. This water by itself cannot be used alone and works only when added to the standard culture media. The growth-promoting factor is polysaccharides[2]. The water can also be fed intravenously. Experiments in Bangkok, Thailand and in St. Louis have shown the possibilities of using it for feeding patients through the veins. A total of 26 infusions into the veins of 21 persons were given without serious reaction [4].

This study is aimed at investigating the effect of fungal infection on the proximate nutrient composition of coconut.

Materials and Methods

Sample collection and preparation: Mature and healthy- looking coconut fruits were obtained from Akure main market, Akure, Ondo state, Nigeria. Infected samples were obtained by breaking the hard shell of healthy fruits so as to expose the innermost white fleshy portion. Samples were kept at ambient temperature until the surface of the exposed part became infected.

Isolation of microorganisms from infected coconut: Potato dextrose agar and coconut extract potato dextrose agar media were prepared, autoclaved at 121^{0}C for 15 minutes, allowed to cool and then poured into sterile Petri dishes. The plates were inoculated from the infected coconut fruits, incubated at 28^{0}C and observed for growth every 24 hrs for up to 72 hrs. Pure isolates were obtained by sub-culturing on freshly poured plates. The fungal isolates were identified according to Barnet and Hunter[6].

Pathogenicity test: The shell of healthy coconut was broken to expose the meat of the fruit. With the aid of sterile inoculating loop, pure fungal isolate was taken from infected coconut into healthy coconut. Inoculated samples were enclosed in sterile transparent polythene bags to avoid contamination as much as possible and then incubated at ambient temperature. Visual observation was made on the inoculated samples on daily basis for symptom development. The uninoculated coconut samples were usually kept as control.

***Chemical analysis*:** The proximate nutrient composition of the healthy and infected coconut fruits were compared on the basis of moisture, protein, fat, crude fibre, ash and carbohydrate using standard method of the Association of Official Analytical Chemists [5].

Results and Discussion

Fungi isolated from the infected coconut include *Aspergillus flavus, Aspergillus niger, Aspergillus fumigatus, Fusarium moniliforme, F. oxysporium Mucor mucedo, M. racemosus, Neurospora sitophila and Rhizopus stolonifer*. Although Kajs et al.[9] have isolated high numbers of bacteria, yeasts and molds from coconut shell, but aseptically removed "meat" and water from undamaged coconuts contained few or no microorganisms. This may be because of the shell of the coconut which covers the inner meat.

Also the moisture content of a sample determines the type of microorganism which can grow in or on it. Molds are generally able to grow on foods with low moisture content. This may therefore account for the growth of the fungi on the coconut. Results of proximate analysis in Table I showed that moisture content of infected coconut (10.39%) was reduced compared to the healthy one (36.44%). On the other hand, the amounts of protein, ash and fat in infected fruit were higher than the quantities recorded from the healthy samples. Reductions in the moisture, crude fibre and carbohydrate contents in infected coconut may be attributed to the fact that the fungi utilized the water and carbohydrate for metabolic activities[7].

Protein content increased from 11.22% in the healthy coconut to 26.57% in the infected one. Fungi have been reported to increase the protein content of samples on which they grow[12,13]. According to Popenoe[10], protein increase could result from slight protein synthesis by proliferation of the microorganisms and a synthesis of enzyme proteins or from a rearrangement of the composition following the degradation of other constituents. The increase in the amount of fat in infected samples (from 20.27% in the healthy sample to 40.75% in infected coconut) may be due to the possible transformation of carbohydrates to fat, as reported by Akindumila and Glatz[1] that certain fungi could produce microbial oil during growth on substrates. This may also explain the reason for the reduction of the carbohydrate content of the infected coconut.

Result of pathogenicity test: After inoculation with *Aspergillus flavus*, the coconut fruit turned green. The incubation period for the growth of the fungus was 72 hrs. Also, *Aspergillus niger* caused the healthy coconut on inoculation to turn black after 72 hrs.The whitish meat of the coconut fruit turned brownish on inoculation with *Aspergillus fumigatus*. Growth of *Neurospora sitophila* on the fruit was pinkish brown while *Fusarium moniliforme* and *F. oxysporium* gave whitish-cottony appearance with very rapid growth. *Rhizopus stolonifer, Mucor mucedo* and *Mucor racemosus* produced whitish mass on the coconut fruit with complete destruction of the meat. The study showed that coconut extract potato dextrose agar favoured the growth of fungi isolated from the infected coconut more than potato dextrose agar. Also infection of the coconut with fungi resulted in increased protein content.

References

[1]Akindumila, F. and Glatz, B.A. 1998.Growth and oil production of *Apiotrichum curvatum* in tomato juice. Journal of Food Protection. **61** (11): 1515- 1517

[2]Anon. 1957. Coconut: mature crops for coconut plantations. *Coconut Bull*. **11**,:357- 366.

[3] Anon. 1962. New coconut products have many applications. Food Eng. **34**(7): 119.

[4] Anon. 1974. Speaking of coconut. *Coconut Bull*. **3**(3): 13- 15.

[5]Association of Official Analytical Chemists. 1990. Official methods of analysis, Washington, D.C. 14th edition, Pp 125- 878.

[6]Barnet, H.L. and Hunter, B.B. 1972. Illustrated Genera of Imperfect Fungi. 3rd edn. Minnesota Burgess Publishing Company, Minneapolis. 241pp

[7]Burnett, J.H.1976. Fundamentals of Mycology. 673pp. Edward Arnold Publishers, Ltd. 2nd edition.

[8]Child, R. 1964. Coconuts. Longman, Green and Co; London. Pp **53**, 73- 79.

[9]Kajs, T.T., Hagenmaier, R., Vanderzant, C. and Mattil, K.F. 1976. Microbiological evaluation of coconut and coconut products. *J. Food Sci*. **41**:352-356.

[10]Kuo, Y.H., Bau, H.M., Quemener, B., Khan, J.K. and Lambein, F. 1995. Solid- state fermentation of *Lathyrus sativus* seeds using *Aspergillus oryzae* and *Rhizopus oligosporus* sp T-3 to eliminate the neurotoxin β- ODAP without loss of nutritional value. Journal of Science, Food and Agric. **69*:*** *81- 89*.

[11]Popenoe, I. 1969. Coconut and cashew: North American Nut Trees. W.F. Humphrey Press, New York.

[12]Raimbault, M. 1998. General and microbiological aspects of solid substrate fermentation. Electronic Journal of Biotechnology. Vol. 1, No. 3.

[13]Rodolfo, A.D., Teresa, M.A., Valdez, S.J. and Mariano, C.M. 2000. Feeding value of protein-enriched sweet potato for Broilers. Research Abstracts, 1997- 2000.

Table 1: Proximate composition of healthy and infected coconut samples (%).

Samples	Moisture	Protein[1]	Ash	Fat	Crude fibre	Carbohydrate[2]
Healthy	36.44	11.22	1.19	20.27	13.13	17.75
Infected	10.39	26.57	1.66	40.75	10.01	10.62

[1]N x 6.25 ; [2]Calculated by difference
Each value is a mean of four replicates.