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Evaluation of Nutrient Composition of Raw and Hydrothermally Processed Watermelon Whole Seed (*Citrullus Lanatus)*

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Abstract — This study was conducted to investigate the nutrient composition of raw and hydrothermally processed watermelon whole seeds at different duration (0, 10, 20, 30, 40 and 50 minutes boiling time) to ascertain their suitability for incorporation into fish feed. The result showed that raw watermelon whole seeds contained 27.77±0.09% of ether extract, 30.35±0.13% Crude fibre and 17.76±0.09% Crude protein. However these parameters increased with increasing duration of hydrothermal processing. 40mins boiling time led to higher crude protein value of 19.26±0.12% while 50 minutes boiling time resulted to highest ether extract and crude fibre (30.78±0.07% and 39.84±0.09% respectively). Incorporating hydrothermally processed of watermelon seed is envisaged to result in better feed conversion in the nutrition of farmed fishes, hence further research is recommended to ascertain this claim.

Keyword — hydrothermal treatment, Proximate composition, unconventional feed.

Introduction

Fish, especially when reared in high density or confined in cages and cannot forage freely on natural foods, require a high – quality, nutritionally complete balanced diet to grow rapidly and remain healthy (18). Generally, nutrition in fish farming is critical because feed represents 40 – 60% of the production cost (28; 30). The rapid world-wide expansion of aquaculture and livestock production strongly indicates that a crisis will be precipitated in the livestock and aquaculture feed industries in the near future. Food for humans is not included in this consideration because, generally speaking, livestock, fish and humans can all eat the same basic food commodities and, in emergencies or times of scarcity, feedstuffs are eaten first by humans (27).

In maintaining the cost of feeding and providing steady supply to the animal under captive rearing, Obasuyi and Nwokoro (25) suggested that locally available feedstuff should be identified, harnessed and utilized. Farmers usually discard various available feed stuff with great potentials for fish feed annually. The price of finished feed in our part of the world continues to be on the rise thereby removing the margin of profit accruing to the fish producers (4). Thus, overcoming the burden of feed ingredients, reducing the cost of fish feed and fish products have been the burden of numerous researchers (5).

Watermelon belongs to the genus Citrullus and family Cucurbitaceae (19). The watermelon fruit, loosely considered a type of melon, possesses a smooth exterior (green and yellow) and a juicy, sweet, usually red, yellow or orange interior flesh (31). Moreover, they are used as domestic remedy for urinary tract infection and hepatic congestion, catarrh, (8). Water melon is reported to be rich in minerals, protein, vitamins, carbohydrate and fibre (9; 29). However, freshly shelled watermelon seed which is usually a waste in this part of the world was reported to have 43.61% crude protein by Lawal, (21). The chemical composition suggests its suitability as a matrix for mineral fortification; this functionality suggests that watermelon seeds are suitable for feed formulations (20). Watermelon seeds are one among the underutilized fruit byproducts (14).

India is the second largest producer of watermelon fruit among the Asian countries producing 255,000 metric tons per year generating 2550 metric tons of seeds per year (14). Though technology, exist for de-coating the seeds, only a small portion of this agricultural commodity is commercially processed and utilized while the remaining is discarded due to practical problems. Protein and fat together accounts for three quarters of the weight of the seeds and is grouped under oil seed, but it has received less attention as an oil seed (16; 13). Existing evidences suggest that, the watermelon seeds proteins exhibit good in vitro digestibility with less of antinutritional factors, the seeds contain moderate quantity of minerals and possess good functionality. Their amino acid composition (high arginine content) is indicative of the possession of the medicinal benefits

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(32). However, for utilizing the seed as a protein source in feed formulations it is equally important to understand the biological availabilities of the minerals. This study attempts to evaluate the nutrient composition of raw and hydrothermally processed watermelon (*Citrullus lanatus*) seed as an unconventional feedstuff for the possibility of inclusion in feed production.

Materials and Methods

Watermelon seed were extracted from fresh and rotten but matured watermelon fruits; they were soaked for (12hours) to separate the seed nut from the fruit flesh (10). The seed were sun dried, packaged in polythene bags and stored for processing. The seed lot was divided into six (6) parts and then processed hydrothermally at five different periods of 0 minutes (T1) serving as control, 10 minutes (T2), 20 minutes (T3), 30 minutes (T4), 40 minutes (T5) and 50 minutes (T6). The processed seeds were analyzed for proximate composition using the method described by AOAC (6).

Results

The result obtained for the proximate composition of raw and hydrothermally processed watermelon seeds for varying period (Table 1) reveals that the crude protein ranged between 17.76± 0.09% to 19.26± 0.12% with the lowest crude protein value recorded in the raw watermelon seed while T_5 (40mins) had the highest value (19.26± 0.12%). T_6 (50mins) had the highest value of 30.78 ± 0.07% for ether extract followed by T_2 (10mins) with the value of 29.17± 0.14% while the least value of 25.33±0.35% was obtained in T_3 (20mins). The crude fibre obtained in this study ranged between 30.35± 0.13% to 39.85± 0.09%, the highest crude fibre was recorded in T_6 (50mins) while the least was in the control. The lowest value of 5.15± 0.03% for moisture content was recorded in T_4 (30mins) and T_5 (40mins) whereas the highest value of 6.22± 0.18% was obtained in T_6 (50mins). The lowest ash content was recorded in T_3 (20mins) (2.67±0.03%) while T_1 (control) had the highest value of 4.28±0.02%, however but there was no significant difference ($p>0.05$) between T_3, T_4, T_5 and T_6. Nitrogen free extract (NFE) shows significant difference ($p<0.05$) among all treatments, with the highest value (13.62 ± 0.04%) observed in T_1 (control) while the least value (1.87 ± 0.07%) was recorded inT_6 (50mins).

Discussion

Crude protein range reported for raw and hydrothermally processed watermelon seed were similar to the value of 20.87% reported by Mustafa and Alamin (23), but higher than that reported by Elezuo *et al.* (11) (16.95%) and lower than that found by Essien *et al.* (12) (24.51%) for the same seed. This might be due to different variety, cultivation condition, soil and seasonal variation or perhaps the ripening stage of the watermelon fruits. The level of crude protein increased with increase in the duration of hydrothermal processing. It may be right to say that the moisture content and the nitrogen free extract of the watermelon seed decreased and shrink when subjected to boiling thereby causing increase in the crude protein levels of the hydrothermally processed watermelon seed . This is in line with the report of Odo (26) that reduction in moisture content of hydrothermally processed breadfruit lead to increase in the level of crude protein from 25.00±0.09% to 28.73±0.06%. Florkiewicz *et. al.*, (15) also reported that the soaking and cooking of seed (irrespective of species) increased protein, fat, calcium and sodium content in dry matter and decreased those of digestible carbohydrates, potassium and magnesium.

The levels of crude protein indicated in this study agrees with the report of (23), who reported that watermelon seed is a good source of protein supplement. Spinelli (27) reported that feedstuffs containing protein in amounts ranging from about 15 to 50 percent falls within the range of the protein requirements for optimum growth of several species of fish. Also according to Lakshimi and Kaul (20) fat and protein together account for three quarter (3/4) the weight of watermelon seeds, this shows that it has good potential as a protein source. Elezuo *et. al.,* (11) suggested that watermelon seeds can be used as basal and protein source, based on their content of fat and fair level protein, hence are suitable for feed formulation. However according to the report of NAERLS (24) and CGIAR (7), the protein supplement sources are those feedstuff containing 20% crude protein or more of plant or animal origin.

The values obtained for ether extracts were higher than 21.33% reported by Elezuo *et al.,* (11) and similar to that obtained by Mustafa and Alamin (23) (30.10%). However Lakshimi and Kaul (20), and Essien *et al,* (12) reported fat content of watermelon seed up to 46.83 and 40.00%. The result also exhibited that the high lipid content of watermelon seed can be used as energy source. Adras et al., (2011) reported that carp can digest and utilize lipid from plant source well which may reduce cost of feeds. Hence studies should be made to investigate carp acceptability of raw and hydrothermally processed water melon. As indicated by the results the crude fibre ranges agrees with value of 38.40% obtained by Mustafa and Alamin (23). Whereas differed remarkably from those reported by Essien *et al,* (12) Lakshmi and Kaul (2011) and Elezuo *et al,* (11), whose values were 2.10%, 4.68% and 2.26% respectively. This could be due to the use of unhulled watermelon seeds, Aguilera *et al.,* (1) reported that protein content in edible legumes may vary markedly according to cultivation conditions, maturity of the grain, and cultivar.

The nitrogen free extract (NFE) range is an indication that it could also be used as carbohydrate feed-stuffs as

suggested by Akiyama (2) and Elezuo (11) reported that warm water fish can digest about 70% of gross energy in oil seed meals which come partially from crude fibre and carbohydrate (NFE). Though fish being non-ruminant such feedstuffs of high crude fibre should be included at minimum levels.

The value of moisture content of the experimental feedstuff are similar to the value of 6.13% obtained by Elezuo (11). Hence watermelon seed are not bio-degradation or bio-perishable feedstuff as the moisture content is within the recommended value for storage, when adequately dried before storage. The ash content varied between 2.67 to 4.28% and closely fall within the range of 1.85 to 5.2% obtained by (22; 17; 23).

Conclusion

The result of the proximate analysis of the raw and hydrothermally processed watermelon seed meal clearly indicated that the level of crude protein increased with increasing hydrothermal processing period, but decreased beyond 30minutes boiling duration. Thus, the hydrothermal treatment improved the crude protein levels. The seeds were observed as a good source of protein and fat, hence their suitability as feedstuff for incorporation into fish diets should be researched into.

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