



Assessment of nutrient contents of wheat offal as vegetable-carried watermelon rind

*Olosunde A.O.¹, Popoola M.A.², Awoyomi O.V.², Mathew B.K.², Awopetu-Adetoro B.O.², Olaniyi T.A.² and Raji A.M.²

¹Bioresources Development Centre Ogbomoso, Oyo State, Nigeria

²Federal College of Animal Health and Production Technology, Ibadan, Nigeria

Corresponding Author: mrbgodveng@gmail.com

Abstract

The study was conducted to evaluate nutrient contents of wheat offal as vegetable-carried watermelon rind. Increasing quantities of fresh watermelon rind (WR) were mixed with wheat offal (WO) as absorbent at the following five blend ratios (WO:WR), 1:1, 1:1.5, 1:2, 1:2.5 and 1:3 and subsequently sun-dried. The sun-dried samples were analyzed for their nutrient compositions and drying periods. Highest dry matter (DM), crude protein (CP), crude fat (CrF), crude fibre (CF), ash and nitrogen free extract (NFE) were obtained in blend ratio 1:2.5 (WO:WR), 1:2 (WO:WR), 1:2.5 (WO:WR), 1:1 (WO:WR) and 1:2 (WO:WR) respectively. Shortest drying period was obtained in blend ratio 1:1 (WO:WR). There was significant difference ($P < 0.01$) in the nutrient contents of the blends. The drying period reduces with reduction in quantity of WR in the blend ratios. The results of this study showed the potential of the combination of WO with WR as animal feed, alternative feed ingredient for conventional feedstuff, disposal route for WR in reducing environmental pollution and wealth produced from waste.

Keywords: Absorbent, blend, nutrient composition, vegetable carrier, watermelon rind, wheat offal

Introduction

The use of fruit wastes and by-products from our indigenous bioresources and agro-industrial waste in animal diet decreases cost of animal feed and increases livestock farmers' income. These unconventional feed resources are good alternative to maize and possibly other feed constituents that compete with human for food (Wadhwa et al., 2015). A substantial amount of fruit wastes and by-products can be added into animal diets, resulting in bringing back the food waste into human food chain with concomitant mitigation of environmental problems that emanate from the decomposition of such wastes in the environment (Wadhwa et al., 2015). The problem of waste management due to huge amounts of the by-products generated is more severe in developing countries because of undeveloped or non-existent of processing methods of converting such by-products into useful products (Odeyinka et al., 2003). As a result, getting rid of the waste poses a problem as most waste turn to pollutants due to improper disposal method and inadequate processing techniques and tools to convert them to useful end products.

Difficulty in the conversion of high-moisture by-products arises from high cost of drying equipment and lack of simple and appropriate alternatives (Makinde and Sonaiya, 2010). One of such agro-industrial by-products is watermelon waste which is mostly dumped and pollutes the environment. Watermelon (*Citrullus lanatus*) is a major fruit widely distributed in the tropics. It contains about 6% sugar and 91% water by weight (Yamaguchi, 2006). The pulp (edible for human consumption) constitutes approximately 68% of the total

weight, while the rind and seed make up approximately 32%, of which 2% is seeds (Hoque and Iqbal, 2015). Like many other fruits, it is a source of vitamin C, serving as a good source of phytochemicals (Perkins-Veazie and Collins, 2004) with a significant amount of citrulline. Watermelon rind powder possesses significant amounts of moisture (10.61%), ash (13.09%), crude protein (11.17%), fat (2.44%), and carbohydrates (56%) (Al-Sayed and Ahmed, 2013). Watermelon rinds are edible and rich in nutrients, but most people avoid eating them because of their unappealing flavor (Mohan and Shanmugam, 2016). For this reason, watermelon rind has become a good candidate for livestock feeding, with a beneficial effect on health. Alagbe (2018) and Okia et al. (2010) reported the potentials of dry watermelon rind as an energy source in rabbit's nutrition. The high moisture content of watermelon rind is a major problem coupled with inadequate processing or drying method. Sun drying which ought to be an easy method will last between 5 and 14 days, depending on environmental condition before dry matter of 88% and above can be achieved. Hence, the need for the development of a quicker drying and conversion method of watermelon rind that can be utilized as alternative animal feed thereby reducing environmental pollution. In earlier research efforts (Makinde et al., 2011) developed a quick method to dry pineapple waste using wheat offal as a vegetable carrier or an absorbent and convert into potential animal feed. There is lack of information on procedure for converting watermelon rind into animal feed using wheat offal. Thus, this study is to develop a simple procedure for converting watermelon rind into animal feed using wheat offal as an absorbent and assess its nutrient values.

Materials and Methods

The study was conducted at Federal College of Animal Health and Production Technology, Ibadan. Wheat offal was obtained from a reliable feed ingredients store in Ibadan. Fresh watermelon rind (Plate 1) was obtained from major fruit markets in Ibadan. The watermelon rind was thoroughly rinsed with water to remove sand particles. The rind was cut into smaller pieces and ground with a machine (Plate 2). It was thoroughly hand-mixed with wheat offal in increasing concentration (Plate 3 and 4). Five blends of wheat offal-carried watermelon rind (WO:WR) were prepared. Following the procedures of (Makinde et al., 2011; Asaolu et al., 2016), the blends (w/w), with each blend (wheat offal: watermelon rind) made in triplicates were: (a) WO mixed with WR (1:1), (b) WO mixed with WR (1:1.5), (c) WO mixed with WR (1:2), (d) WO mixed with WR (1:2.5), (e) WO mixed with WR (1:3). For each of the blends, WR was thoroughly mixed with WO by hand until the fluid from WR was not superfluous (Makinde and Sonaiya, 2007). The blends were evaluated on the capacity to sun-dry to ≤ 10 to 12% moisture content (MC) in 7 hours; as MC $> 12\%$ is not desirable pertaining to good keeping quality (Rozis, 1997). The different blends were sun-dried by spreading thinly on polythene sheets (0.5 mm thickness) on a concrete floor,

with each replicate weighing an average of 0.20 kg. The surface area (m^2) covered by the blends during drying was measured to enable estimation of sun drying rates (as $kg/m^2/h$). Drying started at about 08.30 h and the mixtures were turned at about the first hour into drying. They were also turned about mid-way into the drying process. This involved rubbing handfuls together and spreading again. After the drying period, the blends were sampled for moisture contents and degrees of wetness. Wetness of each blend was estimated as the difference between its initial and final weight.

The sun-drying characteristics data were analyzed with the One-way analysis of variance using the General Linear Model (GLM) procedure of SAS (2004) in a completely randomized design. Significant differences between means were separated using the Duncan's New Multiple Range Test (DNMRT) of the same package.



Plate 1: Watermelon rind



Plate 3: Wheat offal



Plate 2: Grind watermelon



Plate 4: Blending wheat offal with watermelon rind

Results and Discussion

Table 1 shows the nutrient compositions of the different blends of WO-carried WR. The result revealed that the nutrient contents of the blends were significantly affected ($P < 0.05$) by the vegetable carrier at each mixing ratio. Highest dry matter (DM), crude protein (CP), crude fat

(CrF), crude fibre (CF), ash and nitrogen free extract (NFE) were obtained in blend ratio 1:2.5 (WO:WR), 1:2 (WO:WR), 1:2.5 (WO:WR), 1:1 (WO:WR) and 1:2 (WO:WR) respectively. The blend mixing ratios were within 17.44– 18.02 % CP, 1.65-2.59% CrF and 11.02– 13.06% CF.

Table 1: Nutrient composition of different blends of wheat offal and water melon rind

Wheat offal: Watermelon rind						
Parameter (%)	1:1	1:1.5	1:2	1:2.5	1:3	SEM ($\pm$)
Dry matter	88.66 ^b	88.45 ^d	88.02 ^c	89.51 ^a	88.59 ^c	0.13
Crude protein	17.44 ^b	17.44 ^b	18.02 ^a	17.88 ^a	17.44 ^b	0.07
Crude fat	2.49 ^b	1.92 ^c	1.65 ^d	2.59 ^a	2.58 ^a	0.07
Crude fibre	12.02 ^c	13.06 ^a	12.47 ^b	11.51 ^d	11.02 ^c	0.20
Ash	6.64 ^a	6.73 ^a	5.85 ^c	5.52 ^d	6.48 ^b	0.13
Nitrogen free extract	50.07 ^c	49.31 ^d	51.78 ^a	50.05 ^c	51.07 ^c	0.23

a, b, c, d: Means within each row with different superscripts are significantly different ($p < 0.01$)

The nutrient contents of the blend mixing ratio as obtained in this study were in agreement with CP, CrF and CF requirement for rabbit by NRC (1977). The crude protein requirement for rabbits is 12% - 18% DM, protein requirements of rabbits vary with life stage; gestation and lactation require 18% protein, growth requires 15% to 16% protein, and maintenance requires 13% protein (Agricultural Research Council, (1975, 1981); Lebas, (1983); Lebas et al. (1986)). For growing rabbits, 4-H Rabbit Tracks (2017) reported 12 -15% CP, 2 - 3.5% CrF, 20 - 27% fiber, 43 - 47% NFE (carbohydrate), 4 - 6.5% ash

or mineral and for pregnant and nursing, 16 - 20% CP, 3 - to 5.5% CrF, 15 - 20% CF, 44 - 50% NFE and 4.5 - 6.5% ash or mineral. As reported by Jurgens, (1978), feeds that contain averagely more than 18% CF on a dry matter basis are forages and roughages. Feeds containing 20% or more of crude protein (CP) are protein supplements, while those with less than 20% CP are energy feeds. This report showed the potential of the different blends of WO:WR as source of nutrients that could be incorporated into livestock feeds

The drying characteristics of different blends of watermelon rind and wheat offal is presented in Figure 1.

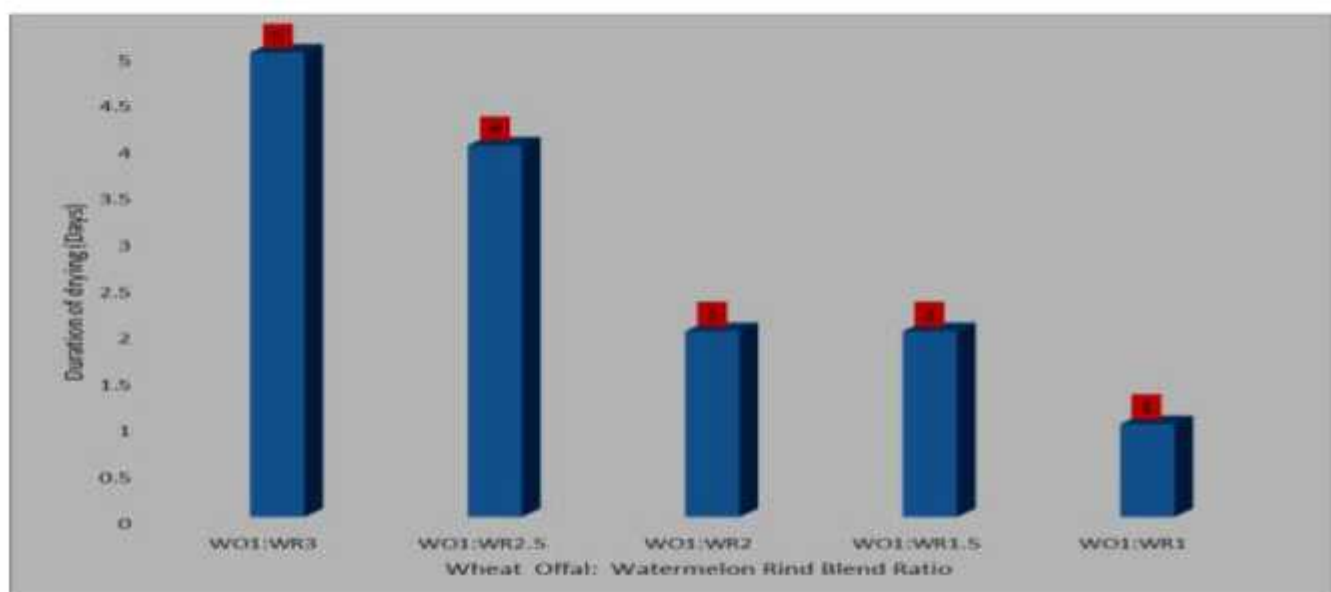


Figure 1. Drying characteristics of different blends of watermelon rind (WR) and wheat offal (WO)

The result revealed shortest drying period in blend ratio 1:1 (WO:WR), followed by 1:2 (WO:WR) and 1:1.5 (WO:WR) while blend ratio 1:3 (WO:WR) recorded longest drying period (5 days). This implies that the less the watermelon rind in the blend ratio the less the drying period. This result underscores the effectiveness of WO as an absorbent as reported in a similar study by Makinde et al. (2011) on pineapple waste (PW). The authors further reported that mixing WO to PW broke PW into smaller units thereby increasing surface area for drying, which shortened drying time significantly. Also, Sonaiya (1988) and Rozis (1997) reported shorter drying times with increased air to product surface exchange area.

Conclusion

The result revealed that the nutrient contents of the blends were significantly affected ($P < 0.05$) by the vegetable carrier at the different mixing ratio. The drying period reduces with reduction in quantity of WR in the blend ratio. The results obtained from this study showed the potential of the combination of WO with WR as animal feed, alternative feed ingredient for conventional feedstuff and a disposal route for WR in reducing environmental pollution.

Recommendation

Further studies should be carried out on the growth and reproductive performance of livestock fed with combination of WO with WR in graded levels.

Declaration of interest

The authors have no relevant financial or non-financial interests to disclose.

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