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Quality characteristics of wheat noodles fortified with spent Shika Brown hen meat powder

[*1]Oyeniran, A.D., [2]Olorunsanya, A.O., [1]Zahraddeen, D. and [1]Olugbemi, T.S.

[1]*Department of Animal Science, Ahmadu Bello University, Zaria.*
[2]*Ibrahim Badamasi Babangida University, Lapai, Niger State.*

[*]***Corresponding Author:*** *oyeniranaderonkedayo@gmail.com;* ***Phone Number:*** *+2348064101770*

Abstract

Meat from Shika Brown® spent hens was used to fortify wheat noodles. Spent hen has a problem of disposal in the fast-food industry due to its inherent tough meat while on the other hand wheat noodles lack quality proteins. Ten (10) spent hens (1.5 years old) were processed to powder in two forms; breast part and leg part and were added into wheat flour in noodles formulation for protein enrichment. The chicken meat powder levels were 10% for 60% wheat flour, 12.5% for 57.5% wheat flour and 15% for 55% wheat flour with 29% of water and 1% of salt. The proximate composition of spent hen chicken meat noodle was determined during the storage periods. Dry matter content in treatment without spent hen chicken meat powder (SHCMP) had the highest value of 94.78% as compared to treatments with 10%, 12.5%, 15% SHCMP (93.50%, 93.24%, 93.99%). Increase in protein content of noodle was observed with increased inclusion levels of SHCMP and declined along with storage period. The breast part had higher crude protein content (22.37%) than leg parts (19.47%). The ether extract content of noodle at 40 days of storage differed significantly (P<0.05) within the inclusion levels and chicken parts. There were significant differences (P<0.05) in the ash content of noodles at 20 days of storage within inclusion levels and chicken parts. It can be concluded that the addition of 10% spent hen chicken meat powder in wheat noodles enhances its nutritive value thereby facilitating growth especially of children in poor nations.

Keywords*: Spent hen, chicken meat powder; refined wheat flour; noodles; proximate composition*

Description of Problem

Chicken meat has higher demand globally because of its low fat and cholesterol contents as well as cheap price (1). In addition, there are no cultural or religious constraints for consumption of poultry meat (2). Spent hen chickens are female birds that complete their egg-laying cycle after 80-100 weeks of age. Their meat has similar nutritive value as that of commercial broilers, and it is a good source of protein (3). The meat is also characterized by toughness because of high amount of stable collagen (4). In particular, breast meat of spent hen chicken is enriched with omega-3 fatty acids and low cholesterol content which already proved its beneficial effect on consumers' health (5). Due to these problems, it has been suggested that the meat can be processed and used for other products (6). Noodles are popular products all over the world due to its ease of cooking, handling and convenience in carrying from one place to another. It is a food of choice for children, women, and highly mobilized population. Incorporation of meat in such snack food can improve its nutritional qualities especially with respect to quality protein, flavour, odour and taste, through changes in formulations and processing;

possibility of incorporation of meat in noodles as a source of protein remains almost unexplored. This study therefore aimed towards evaluation of the quality of spent hen meat powder used in fortification of wheat-based noodles.

Materials and Methods

Source of materials

Ten (10) spent chicken hens (Shikabrown®) of age about 1.5 years were purchased from the National Animal Production Research Institute (NAPRI), Shika, Zaria. Refined wheat flour and common salt were procured from Samaru, Zaria, Kaduna

Processing of Spent Hen Birds

The carcasses were cut into different parts which were grouped into two for the purpose of this study. The first part was the breast part while thigh and drumstick were jointly called leg parts. These cut up parts were rinsed in water, boiled for 35 minutes without adding water to it. After cooking, the skin was removed, and the parts were hand deboned and then cut into smaller pieces in separate containers and was oven dried at 60^{o}C for 1 hour 30 minutes. The processed spent hen chicken meat powder was used in different proportions (10%, 12.5% and 15%) which was incorporated into wheat flour at 60%, 57.5%, 55%, respectively while the control treatment comprised of 70% wheat flour without chicken meat powder as seen in Table 1. Each of the treatments were mixed with 29% of water and 1% of salt.

Table 1: Composition of wheat noodles fortified with spent hen chicken meat powder at different levels

Parameters (%)	Meat powder	Flour	Water	Salt	Total
Control	0.0	70.0	29.0	1.0	100
BP/WF	10.0	60.0	29.0	1.0	100
BP/WF	12.5	57.5	29.0	1.0	100
BP/WF	15.0	55.0	29.0	1.0	100
OP/WF	10.0	60.0	29.0	1.0	100
OP/WF	12.5	57.5	29.0	1.0	100
OP/WF	15.0	55.0	29.0	1.0	100

BP/WF = Breast part with wheat flour, OP/WF = Leg part (thighs and drumsticks) with wheat flour

Chemical characteristics

Dry matter, protein, ether extract and ash content were determined according to the standard procedures of AOAC (7).

Statistical analysis

All data generated were analyzed using package of Statistical Analysis System (8) and Significant mean differences were separated using T-test.

Results and Discussion

Proximate composition of wheat noodles fortified with spent hen chicken meat powder during varied storage periods

The effect of spent hen chicken meat powder (SHCMP) inclusion on the dry matter content of noodles in Table 2 indicated significant ($P<0.05$) differences at 20 days of storage between the inclusion levels and chicken parts. 15% inclusion of SHCMP shows high dry matter content which might be due to low moisture content with increased inclusion level of SHCMP. The finding was in accordance with the report of (9) in which incorporation of 20% chicken meat powder in cookies resulted in higher dry matter content. Similar values

were obtained from 0% and 10%, while the least value occurred in 12.5% SHCMP and this could be due to high moisture contents in SHCMP inclusion in noodles as compared to the control. In the case of chicken parts, the dry matter content increased with SHCMP inclusion of leg part across the storage periods due to low moisture absorption by the product from the environment that gradually permeated through packaging materials, thus similar to the findings of (10) who used chicken drumstick powder as part of ingredient to produce noodle, reported high dry matter content throughout the 25 days of storage by using aluminium pack. SHCMP inclusion levels of breast part, were not statistically different ($P>0.05$) due to the nature and process employed to the part as skinless meat has relatively low moisture content, especially the boneless part which can result in quick low dry matter content during the various storage periods of the product.

Significant differences ($P<0.05$) were observed in chicken parts and various inclusion levels on dry matter content of noodle prepared with spent hen chicken meat at 20 days of storage with the highest value being at 10% and 15% inclusion levels of leg part and 15% breast part. This could be attributed to the increase in various levels of chicken part which tallies with the findings of (11), who used 10% and 15% inclusion levels of chicken thigh and breast powder enriched baguette snacks, according to (12) who says chicken breast part is white and relatively dry due to the nature of the meat cut than the leg cut (drumstick and thigh). In most cases, the packaging material itself is responsible for the control of moisture transfer between the internal and external environment during the storage of the meat products, providing an adequate barrier (13) which could lead to high dry matter content in leg part of the chicken (thigh and drumstick).

The crude protein content of wheat noodle fortified with spent hen chicken meat powder (SHCMP) at 0, 20 and 40 days of storage indicated no significant ($P>0.05$) difference between the inclusion levels and chicken parts but the values showed decreases during the storage with increases in inclusion levels of breast and leg part which may be attributed to quantitative higher protein in chicken meat powder and might be due to breakdown of amino acids as compared to other inclusion levels. The results are in concord with that of (14) in which 36% of chicken powder inclusion produced noodles with crude protein content at 0, 10, 20 and 30 days of storage 21.06, 20.85, 20.69 and 20.57. They also reported no significant difference throughout the storage periods and also collaborated with the findings of (15) in chicken meat biscuit. The highest crude protein content was seen in breast part than leg part due to higher content of essential amino acid in the breast part than leg part (thigh and drumstick) because the higher quality of animal protein is determined due to high lysine and methionine content by utilization of the quality protein content present in the feed given to the birds according to work done of (16). This is related to the findings of (17) who reported the protein content in spent hen chicken breast part was higher than thigh and drumstick parts with means value of 22.37% breast part and 19.47% thigh and drumstick parts, regardless of the chicken breeds.

The ether extract content of noodles fortified with spent hen chicken meat powder (SHCMP) were not significantly ($P>0.05$) different between the inclusion levels and chicken parts at 0 and 20 days. This agrees with the report of (18) which indicated no significant difference ($P>0.05$)in chicken meat noodles from 0 to 30 days of storage but at 40 days of storage, there were

significant increases in ether extract content during storage due to oxidative nature. Noodles product contain high ether extract content and when stored for a long period, undergoes oxidation and become rancid by autoxidation which is responsible for the increased of ether extract during various storage period (19).

Table 2: Proximate composition of wheat noodles fortified with spent Shika brown hen chicken meat powder during varied storage period

[abcd]Means followed by different superscript (s) in the same column are different statistically (*P=0.05)*, Conc. = inclusion levels, SEM = Standard error mean, NS = Not significant, ** = Highly significant (P<0.01), *= Significant (P<0.05).

0 day	Dry matter	Protein	Ether extract	Ash	Nitrogen free extract
IL (%)					
0	94.78	9.33	4.11	1.55	85.01
10	93.50	16.71	3.95	2.32	77.02
12.5	93.24	17.75	4.25	2.10	75.90
15	93.99	20.46	3.98	1.74	73.83
SEM	0.020	0.091	0.008	0.007	0.098
Chicken breast part	93.53	18.60	4.07	2.31	75.01
Chicken leg part	93.64	18.01	4.05	1.71	76.15
SEM	0.029	0.130	0.011	0.009	0.140
Interaction. IL*Parts	NS	NS	NS	NS	NS
20 days					
0	94.14[b]	8.76	4.04	1.94[ab]	85.27
10	94.13[b]	16.01	3.64	1.52[c]	80.51
12.5	93.61[c]	17.08	3.81	2.04[a]	77.08
15	94.57[a]	18.98	4.03	1.83[b]	75.17
SEM	0.023	0.318	0.007	0.007	2.329
Chicken breast part	93.94[b]	17.66	3.83	1.98[a]	76.53
Chicken leg part	94.19[a]	17.04	3.82	1.61[b]	78.64
SEM	0.033	0.455	0.009	0.009	3.328
Interaction. IL*Parts	*	NS	NS	**	NS
40 days					
0	93.12	8.09	3.95[b]	1.95	86.01
10	93.34	12.77	3.28[c]	1.33	82.62
12.5	93.01	13.75	4.05[b]	2.14	80.07
15	94.08	16.85	4.25[a]	2.01	76.89
SEM	0.013	0.224	0.007	0.012	0.196
Chicken breast part	93.29	15.13	3.81	1.89	79.17
Chicken leg part	93.66	13.79	3.90	1.76	80.55
SEM	0.018	0.319	0.009	0.017	0.279
Interaction. IL*Parts	NS	NS	*	NS	NS

The ash content of noodles fortified with spent hen chicken meat powder (SHCMP) showed highly significant (P<0.05) difference between the inclusion levels and chicken parts at 20 days of storage. The highest ash content noticed in treatment with 12.5% SHCMP was due to higher mineral content in chicken meat than noodle without SHCMP. Author (20) reported a significant increase in ash content on addition of chicken meat powder in noodles from 0.62 to 1.86%. The control treatment (0%) and 15%

inclusion results were not different and this agreed with the work of (14) on chicken meat noodles in which the ash content decreased in both treatment and control during 10 to 30 days of storage, although it was not significant. Earlier author (6) stated that higher ash content in bakery products is beneficial due to their positive effects on health such as decreasing the risk of chronic diseases (diabetes, heart diseases). In chicken part, at 20 days of storage there were significant differences ($P<0.05$) between the breast parts than leg part which showed higher values in breast part. The high ash content in breast part SHCMP inclusion in this study is supported by the finding of (21, 22) who reported higher ash contents in chicken breast part compared to leg part. Nitrogen free extract were also not significant across the various storage periods.

Table 3: Interaction between chicken parts and their various inclusion levels on proximate composition of wheat noodles fortified with spent hen chicken meat powder during varied storage period

	Chicken parts		
Inclusion Levels (%)	Breast	Leg part	SE±
20 days			
Dry matter			
10	93.85^{b}	94.39^{a}	
12.5	93.53^{b}	93.69^{b}	0.123
15	94.49^{a}	94.49^{a}	
40 days			
Ether extract			
10	3.11^{d}	3.45^{c}	
12.5	4.01^{b}	4.08^{b}	0.067
15	4.32^{a}	4.18^{ab}	
20 days			
Ash content			
10	1.47^{d}	1.55^{c}	
12.5	2.51^{a}	1.57^{c}	0.066
15	1.94^{b}	1.72^{bc}	

^{abcd}Means followed by different superscript (s) in the same row and column are different statistically (*P=0.05)*, SE= Standard error.

Interaction between chicken parts and their various inclusion levels on proximate composition of wheat noodles fortified with spent hen chicken meat powder during varied storage periods

Significant interactions existed between chicken parts and inclusion levels were observed with reference to ash content at 20 days of storage, as seen in Table 3. Treatments with 12.5% and 15% breast part SHCMP had higher values than leg part due to the high mineral content in the breast part, which agrees with the findings of (23, 24). Ash in food determines largely the extent to which the dietary minerals would be available in a particular food sample. Interaction between the chicken parts on ether extract content of spent hen chicken meat noodles at 40 days of storage was observed. The highest ether extract content values recorded in treatment with 15% SHCMP breast part and leg part indicated no

differences between the parts, 12.5% SHCMP breast and leg part inclusion levels both had similar highest value. The increasing trend of ether extract content in the products with increase in SHCMP inclusion levels may be due to higher ether extract content in chicken meat, which is related to the report of (25) on ether extract content in dried chicken meat mince incorporated in comparison to the corn grits used.

Conclusion and Applications

1. The noodles produced with 10% and 12.5% inclusion of spent hen chicken meat powder gave better results compared to noodle produced with 15% spent hen chicken meat powder in terms of proximate composition during storage period.
2. The addition of 10% spent hen chicken meat powder is recommended to be added to wheat noodles to enhance its chemical properties.
3. It also serves as a good nutritive tool in improving the nutrient intake of its consumers thereby facilitating growth especially of children in poor nations.

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