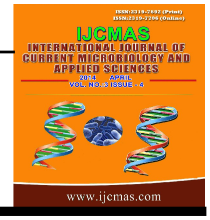

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Original Research Article

Acceptability of moin-moin produced from blends of african yam bean (*Sphenostylis stenocarpa*) and cowpea (*Vigna unguiculata*)

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A B S T R A C T

African Yam Bean (*sphenostylis stenocarpa*) and cowpea *(vigna unguiculata*) were used to prepare moi-moi at different substitution levels of 90%:10% (cowpea) AYB down to 50%:50%(cowpea, African yam bean] and vice versa. The moi-moi produced was subjected to sensory evaluation, by 20 panelists and also proximate composition analysis. From the results obtained from the proximate composition analysis, it was observed that the crude protein of raw cowpea flour 25.24% was higher than that of the raw African yam bean flour (18.33%) which was soaked in water and 17.01% for African Yam Bean soaked in sodium bicarbonate. The ash content and crude fibre were also higher in cowpea flour than in African yam bean flour having 2.50% cowpea, 2.27%, (AYB in water) and 1.80% (AYB in bicarbonate) for crude fibre and 2.31%, 1.82% and 1.60% for Ash respectively. There was no significant difference between the crude fibre content of the blends. The moisture content increased with increase in the ratio of cowpea and vice versa. The fat content increased with the increase in the ratio of African yam bean. For the Sensory parameters tested, the 100% cowpea moimoi was most acceptable though there was a good comparism in the substitution level of up to 60%:40% (cowpea, African yam bean). The panelist did not entirely reject, but neither liked nor disliked the 90%:10% (African yam bean, cowpea) substitution, though the 100% African yam bean moi moi was the least accepted. It could then be said that African yam bean should be soaked with sodium bi-carbonate which helps to reduce it's beany off flavour which makes its taste unacceptable and improve its acceptability.

Keywords

African yam bean, Cowpea, proximate analysis, moimoi, beany off flavour.

Introduction

African yam bean *(Sphenostylis stenocarpa)* and cowpea (Vigna unguiculata) are among the legumes found in tropical regions of the world. They belong to the same family of Leguminosae, and sub family of Papilionaceae. African yam bean itself is a typical African plant grown in most parts of the hot and humid tropical regions at middle and low altitudes and more specifically in southern Nigeria (Raemaekers, 2001). Each of these legumes is locally known with different names in different parts of Nigeria with respect to different tribes and ethnic groups. African yam bean is commonly called "Okpodudu" or "Azuma" in several parts of Igbo land and "**Bebe**" by the Yoruba's and "Kashin Kaji" in the Northern State of Nigeria. (Okigbo, 1993). Cowpea or southern pea is commonly called "Agwa" in Igbo land and "Ewa" in Yoruba land.

Cowpea seed is a nutritious component of the human diet. The nutrient content of matured cowpea seed are; 11.5% of water, 340kcals of energy, 22.70% protein, 1.6% fat, 61.0% carbohydrate, 4.20% crude fibre, and 3.20% Ash, while calcium, iron, thiamin, Riboflavin and nicotinic acid are in small quantities (Ihekoronye and Ngoddy, 1985). Also African yam bean contain 20.51% protein, 10.20% fat, 52.33% carbohydrate, 6.00% crude fibre, 2.60% ash and 8.36% water, while calcium and 12 phosphorus are in trace amounts (Adeyeye et al.,1994). The amino acid content of its protein was very similar to that of soybean though rather higher in histidene and iso-leucine.

The tubers and seeds of African yam bean are cooked and eaten alone or in combination with vegetables or other foods. Usually the tubers are eaten the same manner as potatoes which they resemble in flavour while cowpea can also be eaten cooked or also with other foods. Cowpea flour is used in preparation of bean cakes such as "moin-moin" and "akara". (Abbey and Ibeh 1988).

The problems associated with African yam bean include hard shell of the seed, hardening, antinutritional factors, mould growth if not well stored, long cooking time, post harvest storage defects, changes in flavour and odour while cowpea contain goitrogen substances which cause enlargement of thyroid glands. Cowpea is also hard to cook but it cannot be compared with that of African yam bean and it causes flatulence among susceptible individuals which may cause extreme discomfort (Ihekoronye and Ngoddy, 1985). African yam bean is underutilized despite its composition and the problems associated with it has made it difficult for its full utilization.

Therefore the objective of this study is to produce moin-moin from a combination of African yam bean and cowpea and to evaluate the level of acceptability on the substitution levels of the two blends with the aim of promoting the utilization of African yam bean.

It is hoped that a good product if obtained will help to increase its utilization and also prevent it from going into extinction.

Materials and Methods

Materials

African yam bean (*Spenostylis stenocarpa*) seeds were purchased from a local market in Aba, Abia state. Cowpea (*Vigna ungiuculata*) was also purchased from Ekeonuwa market in Imo state. Other ingredients such as Cray fish, chilli pepper, groundnut oil, onions, red pepper, salt and maggi were all gotten from Ekeonuwa market, in Owerri Imo State.

Chemicals: The chemicals used such as sodium bicarbonate ($NaHCO_3$) were of analytical grade and obtained from the Department of Food Science and

Technology of the Federal University of Technology Owerri.

Equipment: The equipment used were gotten from the Departments of Food Science and Technology and Crop Science and Technology of the Federal University of Technology, Owerri.

Sample preparation

African yam bean (AYB) and cowpea seeds were sorted to remove extraneous materials and damaged seeds.

Soaking In Water

One kilogram (1kg) of African yam bean and three kilograms (3kg) of cowpea were soaked differently in tap water for 48hours and 15minutes respectively to facilitate the dehulling of the seeds. After dehulling the seeds were dried in a gallenkamp hot box oven at 50-60^{0}C for 5hours and milled using a hammer mill. The flour was kept in a dry, air-tight plastic container for further use.

Soaking In Alkali ($NaHC_{03}$)

Also another portion of African yam bean (3kg) was soaked in sodium bicarbonate for 10hours to facilitate reduction of beany off flavour and dehulling of the seeds. After dehulling the seeds were oven-dried, milled and packaged.

Preparation of 'Moi moi' samples

Moin-moin samples were prepared from a cowpea and AYB flours at a substitution levels of 90:10; 80:20; 70:30, 60:40 and 50:50 (Cowpea :AYB) and vice versa. This flour combinations were added 10g onions, 4g red pepper, 40mls of vegetable oil and 900mls of water according to recipe (Enwere, 1998). The amount of the ingredients used were the same in all the moi moi samples. Twelve samples were produced using the different ratios above and were wrapped with foil paper and cooked for 50min. The cooked samples were then subjected to both proximate analysis and sensory evaluation.

Proximate analysis

The procedures for the proximate analysis are as outlined by the Association of Official Analytical Chemist (A.O.A.C., 1990) for fat, Ash, crude protein, moisture, crude fibre and carbohydrate.

Moisture Content Determination

The oven method was used. 5kg of each sample was weighed into a dried crucible. The samples were dried in a moisture extraction oven at 105^{0}C for 3hours. The dried samples were cooled in a desiccator and weighed. They were dried again, cooled, and reweighed. This process was repeated until a constant weight was obtained. The difference in weight before and after drying was recorded as moisture content.

$$\% \text{ Moisture} = \frac{W2 - W3}{W2 - W1} \times 100$$

Where W1 = initial weight of the empty dish

W2 = weight of the dish + undried sample

W3= weight of the dish + dried sample

Ash Content Determination

Two grams of each sample was weighed into a crucible and heated in a moisture extraction oven for 3hours at 100^{0}C before being transferred into a muffle furnace at 550^{0}C until it turned white and free of

Figure.1 Flow diagram for the production cowpea bean flour

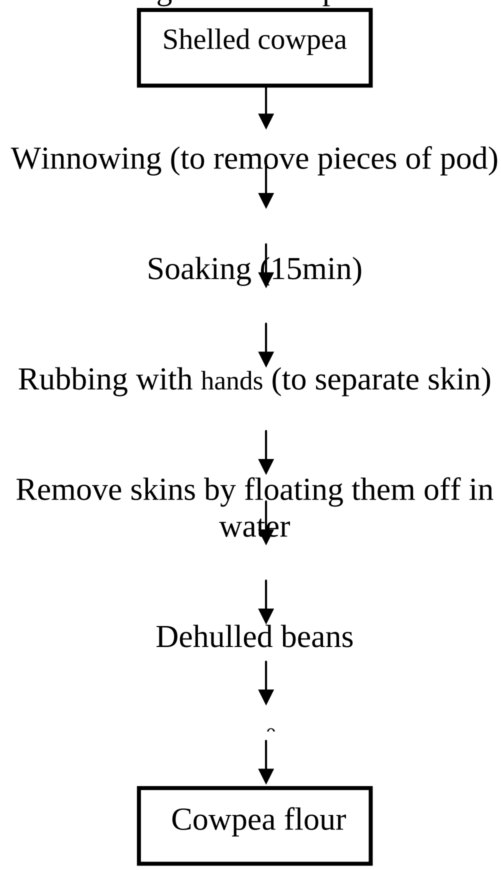
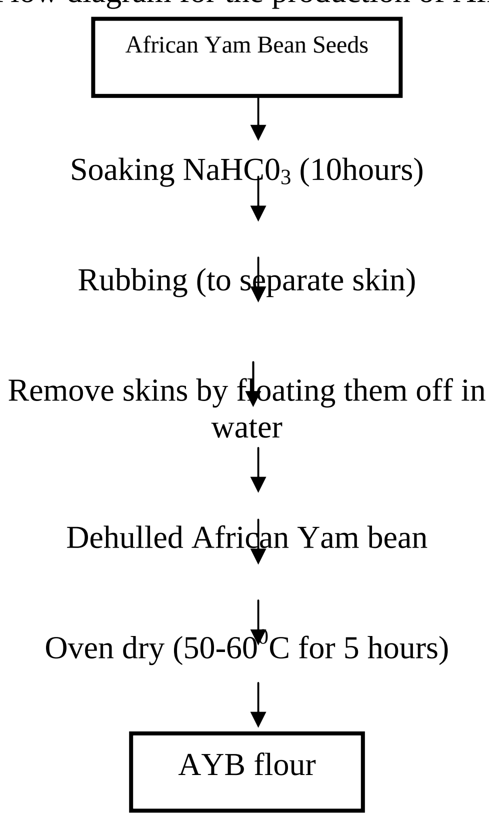


Figure.2 Flow diagram for the production of African Yam Bean flour



carbon. The sample was then removed from the furnace, cooled in desiccators and reweighed. The weight of the residue was then calculated as ash content.

$$Ash\% = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Crude Protein Determination

Kjeldahl method described by A.O.A C (1990) was used. Two grams of each of the samples was weighed into the Kjeldahl flask followed by 0.1gm of copper sulphate and 2.5g anhydrous sodium sulphate granules as catalyst. 25ml of concentrated sulphuric acid was measured into each flask and 10 anti-bumping glass beads were added to each flask. The samples in the flask were digested on the Kjeldahl apparatus. A light green colour was obtained after 2 hours. The heating was stopped and the content (digest) in the flask changed from green to colourless. The flasks were placed in the fume cup board, covered with cotton wool, the digest was transferred into a 100ml volumetric flask and made up with distilled water. Ten millimeter (10ml) portion of the digest was mixed with equal volume of 45% NaOH solution and poured into Kjeldahl distillation apparatus. The mixture was distilled and the distillate collected into 4% boric acid solution containing 3 drops of methyleneblue indicator. A total of 50ml distillate was collected and titrated as well. The sample was duplicated and the average value taken. The nitrogen content was calculated and multiplied with 6.25 to obtain the crude protein content.

$$\% \text{ Nitrogen} = \frac{100 \times N \times 14 \times Vf \times T}{100 \times Va}$$

Where

W = weight of the sample
N = normally of the titrate (0.1N)
Vf = total volume of the digest = 100ml
T = titre volume
Va = Aliquot volume distilled

Fat Determination

Two grams of sample was loosely wrapped with a filter paper and put into the thimble, fitted to a flask which had been cleaned, dried and weighed. The flask contained 120ml of petroleum spirit. The round bottom flask in the soxhlet extraction unit was slowly heated for 5hours. The heating was then stopped and the thimbles with the spent samples were cooled in the desiccators and later weighed. The difference in mass was calculation as fat.

$$\% \text{ Fat} = \frac{W2 - W1}{W3} \times 100$$

Where,

W1= Weight of the empty extraction flask
W2=Weight of the flask and oil extracted
W3 = weight of the sample

Crude Fibre Determination

Two grams of each treatment was digested in a conical flask with 200ml of 1.25% H_2S0_4 solution and boiled for 30minutes. The solution and content was poured into a Buchner funnel equipped with muslin cloth secured with an elastic band. This was allowed to filter out, then the residue was washed with hot water to free the acid. The residue was scooped into a conical flask and digested with 200ml of 1.25% NaOH solution. It was boiled for 30minutes then transferred to the Buchner funnel and filtered. It was then washed twice with hot water. The residue obtained was put in a clean, dried crucible and dried in the moisture extraction oven to a constant weight. The dried residue was placed in a muffle furnace until it turned into ash. It was then cooled in the dessicator and weighed to enable calculation of the percentage crude fibre.

$$\% \text{ Crude fibre} = \frac{W1 - W2}{Wt} \times 100$$

Where,

W1 = weight of sample before incineration
W2 = weight of sample after incineration
Wt = weight of original sample

Carbohydrate Determination

The carbohydrate was calculated by difference between 100 and the summation of other proximate parameters as nitrogen free extract.

$$\%CHO = 100 - (M + P + F + A + C1)$$

Where,

M = Moisture; P = Protein; F =Fat; A = Ash; C = Crude fibre

Sensory Evaluation of the Moin-Moin Samples

Twelve different samples were evaluated by 20 members of untrained panelist. The panelist evaluated each of the samples for appearance, mouth feel, taste, Aroma, and over all acceptability. A nine point hedonic scale as described by (Ihekoronye and Ngoddy,1985) was used to carry out the Analysis of variance (ANOVA) as follows

9 = Like extremely; 8 = Like very much; 7 = Like moderately;
6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly;

3 = Dislike moderately; 2 = Dislike very much; 1 = Dislike extremely

Results and Discussion

Proximate analysis

From the results of the proximate composition as shown in Table 1, the 100% cowpea "moi moi" (sample A) had the highest moisture content (14.98) followed by sample AA (90% cowpea with 10% AYB) of 14.51% moisture. The least moisture content was obtained from the AYB control sample soaked in sodium bicarbonate (RC) (11.96%). This could be attributed to the absorption of water by the sodium bicarbonate from the raw sample. Also the higher the amount of cowpea flour, the higher the moisture content due to high water absorption of cowpea flour.

For cowpea blends, the ash content increased with increase in the proportion of cowpea which originally had a higher level of mineral content (2.31%). The ash content of the samples substituted with African Yam Bean did not vary much (60 – 90%) but ash content increased slightly with 70 – 90% substitution with cowpea. This could be attributable to the higher mineral content of cowpea as shown in Table I.

The value of the crude fibre contents of the samples decreased from that of the raw sample. This decrease could be as a result of dehulling of the seeds prior to milling since most of the crude fibre are found in the mills. Dehulling of legume seeds increase protein and ash but reduces crude fibre (Okechukwu, et al; 1992; Okaka, 1997).

The fat content of legumes is known to be within the range of 0.6 – 5.00% of which the sample here falls in. The increase in the fat content of the samples was as a result of the oil that was added during preparation of the "moi-moi" samples.

Legumes are valuable source of carbohydrates, hence blends of cereal legume diet will satisfy both the protein and carbohydrate requirements of man. From the results of the proximate composition, it could be said that "moi-moi" made from African Yam Bean still contains appreciable nutrients as those made with the cowpea normally used by most consumers as reported by Potter and Hotchiss (1995). All the samples were in the range of 19.5% protein according to Okigbo (1993). The result for carbohydrate content from the table revealed that the control - African yam bean soaked in sodium bicarbonate - rated the highest and the least was sample AB(80% cowpea, 20% African yam bean), the high content of carbohydrate made the 'moin-moin' to swell and gelatinize (Potter and Hotchkiss, 2006). Enwere and Ngoddy, 1986) The result for the crude fibre revealed that all the samples were statistically the same. The result for fat showed that sample B (100% African yam bean soaked in water) and sample BA(90 African yam bean :10 cowpea) rated the highest while cowpea flour was the least. This was probably because African yam bean contained higher amount of fat than cowpea and also because sample B (100% African yam bean soaked in sodium bicarbonate) was not soaked for a long time. Soaking decreases the fat content of the samples. The raw samples and the blends was in the range of 19.5% protein 2.5% fat, 61.6% carbohydrate for African yam bean and 61-66% carbohydrate, 24-25% protein and 2% fat (Okigbo, 1993) for cowpea.

The result of the mean sensory scores of moi moi produced from blends of AYB and cowpea is shown in table 2. The moi moi samples were analysed in terms of appearance, taste, aroma, mouth feel and overall acceptability. From the results, it was observed that there was a significant difference ($P \leq 0.05$) between the 100% cowpea "moi moi" and all the other samples except for the 80% and 90% cowpea blends which had a mean value of 7.26, 7.46 and 7.60 respectively. The AYB soaked in water and used to produce 100% "moi moi" had the least mean value in terms of appearance (4.60). This could be as a result of enzymic browning that took place during the dehulling of the AYB seeds which made the panelist to dislike it. Amongst all the samples, sample A (100% cowpea) rated highest in all the sensory parameters examined. This was followed closely by samples AA (90% cowpea, 10% AYB) and sample AB (80% cowpea, 20% AYB). The least accepted sample by the panelist was ample B (100% AYB soaked in water) with a mean value of 5.53 and sample BA (90% AYB and 10% cowpea) with a mean score of 4.46. Sample C (AYB soaked in $NaHC0_3$) had a better flavour when compared with sample B (AYB soaked in water) because the bicarbonate soaking helped to reduce the beany off flavour that is prevalent in AYB. Based on overall acceptability, a significant difference ($P \leq 0.05$) existed between the 100% cowpea "moi moi" (A) and all the other samples and was the most accepted. Also no significant differences was observed between samples AA, AB

Table.1 Mineral content of cowpea as shown in Table I

SAMPLES	PROTEIN	MIOSTURE	FAT	CRUDE FIBRE	ASH	CARBOHYDRATE
RA	25.24a	12.64 fg	1.20 k	2.50 a	2.31ab	56.11 b
RB	18.33 g	13.20de	5.01g	2.27a	1.82cd	59.37 a
RC	17.01 h	11.96h	8.00c	1.80a	1.60cd	59.63a
A	23.50 b	14.98 a	2.00 j	2.53a	2.45 a	54.37 g
B	19.50 ef	14.01 bc	7.02 de	2.30a	1.83bcd	55.34 d
C	18.13g	12.16gh	10.20a	1.97a	1.49d	56.05b
AA	23.13 b	14.51 ab	3.19 i	2.19 a	2.27 ab	54.71 g
AB	22.25 c	14.11 bc	4.16 h	2.16 a	2.16 ab	55.16 def
AC	21.33 c	13.66 d	5.03 g	2.14 a	2.06 abc	55.23 .de
AD	20.63 d	13.56 d	5.76 f	2.12 a	1.99 abcd	55.94 bc
AE	20.31 de	13.46 d	6.60 e	2.11 a	1.95 abcd	55.51 cd
BA	19.00 f	12.46 fgh	10.11 a	2.02 a	1.57 cd	54.84 efg
BB	19.38 f	12.86 ef	9.10 b	2.06 a	1.72 cd	55.20 def
BC	19.94 e	13.16 de	8.20 c	2.08 a	1.83 bcd	54.79 fg
BD	19.38 f	13.36 de	7.44 d	2.10 a	1.91 bcd	56.19 b
LSD	0.50	0.51	0.52		0.50	0.41

Note: ^{abc} mean with different superscripts in the same column are significantly different from each other at $P \leq 0.05$.

* RA – Raw Cowpea; * RB – Raw African yam bean flour soaked in water; * RC – Raw Material for African yam bean soaked in Sodium bicarbonate; * A – Control 100% cowpea moi moi; * B –100% moi moi from African yam bean soaked in water; * C – 100% moi moi from African yam bean soaked in Sodium bicarbonate; * AA – 90% Cowpea, 10% AB; African yam bean; * AB – 80% Cowpea, 20% AB African yam bean; * AC – 70% Cowpea, 30% AB African yam bean; * AD – 60% Cowpea, 40% AB African yam bean; * AE – 50% Cowpea, 50% AB African yam bean; * BA – 10% Cowpea, 90% AB African yam bean; * BB – 20% Cowpea, 80% AB African yam bean; * BC – 30% Cowpea, 70% AB African yam bean; * BD – 40% Cowpea, 60% AB African yam bean **.**

Table.2 Mean sensory scores of moi moi produced from blends of AYB and cowpea

SAMPLE	APPEARANCE	TASTE	AROMA	MOUTHFEEL	OVERALL ACCEPTABILIY
A	7.26^{ab}	7.66^{a}	7.26^{a}	7.86a	7.86^{a}
B	4.60^{de}	4.86^{cd}	4.93^{d}	5.86^{bcd}	5.53^{c}
C	6.46^{dc}	6.13^{bc}	5.73^{bcd}	6.40^{bc}	6.46^{bc}
AA	7.46^{a}	7.06^{ab}	6.60^{ab}	7.00^{ab}	7.13^{ab}
AB	7.60^{a}	7.40^{a}	6.89^{ab}	7.06^{ab}	7.13^{ab}
AC	6.93^{abc}	6.46^{b}	6.46^{ab}	6.60^{b}	6.86^{b}
AD	6.20^{cd}	5.93^{bc}	6.26^{b}	6.06^{bc}	5.80^{c}
AE	6.06^{cd}	5.66^{bc}	5.60^{bcd}	5.53^{cd}	5.60^{c}
BA	5.13^{d}	4.73^{d}	5.06^{d}	4.93^{d}	4.46^{d}
BB	5.20^{d}	5.80^{bc}	5.13^{cd}	5.33^{cd}	5.06^{cd}
BC	5.33^{d}	5.40^{cd}	5.66^{bcd}	5.60^{bcd}	5.53^{c}
BD	6.00^{cd}	5.73^{bc}	5.60^{bcd}	6.00^{bc}	6.06^{bc}
LSD	0.907	0.0927	0.955	1.050	0.901

Note: ^{abc} means with different superscripts in the dame column are significantly different from each other at $P \leq 0.05$.

* RA – Raw Cowpea; * RB – Raw African yam bean flour soaked in water; * RC – Raw Material for African yam bean soaked in Sodium bicarbonate; * A – Control 100% cowpea moi moi; * B –100% moi moi from African yam bean soaked in water; * C – 100% moi moi from African yam bean soaked in Sodium bicarbonate; * AA – 90% Cowpea, 10% AB; African yam bean; * AB – 80% Cowpea, 20% AB African yam bean; * AC – 70% Cowpea, 30% AB African yam bean; * AD – 60% Cowpea, 40% AB African yam bean; * AE – 50% Cowpea, 50% AB African yam bean; * BA – 10% Cowpea, 90% AB African yam bean; * BB – 20% Cowpea, 80% AB African yam

and AC while significant differences existed between these and all the other samples. All the samples were accepted except sample BA (90% AYB and 10% cowpea and samples B (100% AYB in water).

In terms of Aroma, sample A (100% cowpea) and sample AA (90% cowpea, 10% African yam bean) was statistically the same. Sample AB (80% cowpea, 20% African yam bean) and sample AC (70% cowpea, 30% African yam bean) were also statistically the same. The least was the control of African yam bean soaked in sodium bicarbonate.

African Yam Bean can be used to partially substitute cowpea in moi-moi preparation. Steeping of AYB in sodium bicarbonate helped to reduce the beany off flavour more than the ones soaked with water only; and produced more acceptable 'moi-moi' than the later. There was an acceptable product up to 30% substitution with AYB although at higher substitutions and 100% AYB, there was a significant difference ($P \leq 0.05$) with the other samples from overall acceptability.

The use of AYB (*sphenostylis sternocarp*) as a partial substitute in the production of 'moi-moi' was acceptable, up to certain levels and is obviously cheaper than using 100% cowpea. The different conditions utilized in the pre-treatment of the AYB seeds should be optimized in order to promote the acceptability of AYB as a substitute for the production of 'moi-moi' or even 'akara' (bean ball). Also incentives should be given to farmers so that they can cultivate more AYB and distribute them to other areas effectively.

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