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Supplementation of Yoghurt with Kawal

تدعيم الزبادي بالكول

A dissertation submitted to Sudan University of Science and Technology in Partial Fulfillment of the Degree of B.Sc. (Honours) in Food Science and Technology

By

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Dedication

To my Family,

To my Teachers,

To my Friends,

Acknowledgement

First of all, I render my gratitude and praise to the Almighty Allah (S B T).

I wish to express my sincere gratitude to my supervisor **Associate Prof. Dr. Mhadi Abbas saaed Shakak** for his helpful guidance, encouragement and supervision of this research.

I want to thank the all the staff of Department of Food Science and Technology in Sudan University of Science and Technology for giving me the permission to perform this study.

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Abstract

I conducted atrial to supported the yoghurt with kawal after knowing the nutritional value of kawal and yoghurt .

I found that the amount of protein in the kawal is higher than the quantity of yoghurt . The percentage of protein in kawal was 9.62%. I also analyzed the fat percentage and found 5.23%.

This analysis is to increase the nutritinal value of kawal and to compensate for protein deficiency in the poor embryo.

ملخص البحث

لقد قمت بإجراء تجربه لتدعيم الزبادي بالكول بعد معرفه القيمة الغذائية للكول والزبادي ووجدت أن نسبة البروتين في الكول أعلى من الزبادي. نسبة البروتين في الكول 9.62% وأيضا حللت نسبة الدهون ووجدتها 5.23% هذا التحليل لزيادة القيمة الغذائية للكول ولتعويض النقص في البروتين في الدول الفقيرة .

CHAPTER ONE

1. INTRODUCTION

The past few decades have witnessed an increased interest in the foods of Africa. This interest may be due to the following:

1- Recurrency of famines that hit the continent during that period.

2- Some tentative researches proved that some of these foods are of high nutritive value e. g. Kawal, Furndu and Sigda.

3- Availability of raw materials of these traditional foods.

4- Possibility of modernizing them, keeping in minds that number of well known foods e. g. bread, cheeses and yoghurt were originally traditional foods in a certain regions and by research they were developed and became accepted throughout the world.

The most commonly used from meat in the rural Sudan is sun dried strips of beef, called shermute which has a faint putrid odor.

In what region of Sudan?

Until a few years ago Kawal was poorly to most Sudanese for it was a product confined to the Western regions of the Sudan.

Kawal has spread in recent years across the Sudan from West to East and up and down the Nile.

1.2 Definition of kawal

it is green leaves of Cassia obtiusifolia . it is sub family of Cassia are fermented to produce of food product (kawal) .

1.3 Importance of kawal

- Kawal riched of protein content about 20% on dry matter basis.
- It is curing of many diseases such as cancer.
- Decreases of increase pressure blood.

1.4 Objectives

- To add kawal traditional food as enhancing nutritional value and forming agent for yoghurt.
- To help alleviate the world shortage in protein.

1.5 Importance of yoghurt

- Yoghurt is considered as healthy food due to its high digestibility and bio availability of nutrients.
- It can be recommended to the people with lactose intolerance.
- Yoghurt is more nutritive than milk in vitamin contents for its digestibility.
- It is also used as source of calcium and phosphorous.
- Yoghurt is rich in protein, riboflavin, vitamin B6 and B12.

CHAPTER TWO

2.LITERATURE REVIEW

2.1The plant

The kawal has been identified as Cassia obtiusifolia L. it has compound pinnate leaf composed of 3 pairs of leaf lets. The leaf lets are obviate, mucronate at the apex , up to 6.25 cm long and 3 cm broad . Flowers are yellow to orange and the pod slender and up to 20 cm long. Cassia obtiusifolia has been described variously as an under shrub, an herbaceous plant and a weed. The plant grows wild in central plains of the country and in the southern region, it is not cultivated.

2.2 Scientific classification

Kingdom: plantae.

Order: fables.

Family: fabaceae

Sub family: caesalpinioideae .

Tribe: Cassieae .

Sub tribe: Cassiinae .

Genus: Senna .

Species: S. obtusifolia.

2.3 Synonyms

Cassia humilis .

C. humilissteud .

C. Obtiusifolia L.

C. tora L. is synonm of Sennatora.

C. tora L. var.b Wight, arm.

C. tora L. var .humilis .

C. tore L. varobtusifolia.

2.4 Uses of kawal

2.4.1 Edible uses

- The young, tender leaves are occasion used a vegetable throughout Africa and elsewhere. Older leaves, if eaten frequently or in large quantities, will cause diarrhea. The powder and fermented leaves are used as condiment.
- A pale yellowish juice produced in the fermentation process is skimmed off and make into a stew with okra.
- Roasted seeds have been used as substitute for coffee.
- The leaves are used to make tea.
- The seeds are occasionally dried and ground into a powder, which is cooked and eaten as a staple food in moderate amounts.
- The seeds contain commercially interesting levels of gums.

2.4.2 Medicinal uses

They are used to rid the body of parasites and as a treatment a agonist vomiting and stomach -ache.

They are used to treat skin infection, sores and insect bites .A decoction of the leaves is used to treat eye complaints.

The seeds are eaten, combined with a leaf decoction, to treat conjunctivitis.

2.4.3 Other uses

The seeds, the macerated leaves and the roots provide black, blue, yellow and orange dyes.

A yellow phenolic pigment, cassia xanthenes, has been isolated form the roots of Senna species.

2.5 Cultivation details

Plants succeed in the tropics and a deep, well drained, moderately fertile sandy loam and a position in full sun.

The plant can spread freely and it is considered to be a weed in many parts of the world.

Cassia is a short -day plant, but exact light requirements for flower initiation differ by provenance. It is self pollinating and inter -specific crosses have not yielded viable seed.

2.6 Fermentation method

Leaves were collected at the flowering and fruiting stage. They were then cleaned of impurities, such as flower petals and leaves of other plant, worm, insects or insects damaged leaves were remove.

The leaves pounded in a wooden matter until they formal paste, without loose of juice. The leaf paste was packed tightly, with the hand, in an earth ware jug (capacity 30 ml) previously buried in a pit in the ground in a cool, shaded place. Only the neck if the jug was above ground level. The surface of the packed leaf paste was covered with a pile of twisted green sorghum leaves. The jug (zeer) was then covered with a suitable lid and mud, and fermented for 2 week.

Every 3 days the zeer was opened, the dried sorghum leaves removed and the fermenting paste hand- mixed, crushing the material between the fingers. The leaf paste was then repacked.

Fresh green sorghum leaves used to replace the old yellow ones and the zeer resealed.

Samples for pH determination were taken at the time of mixing.

After incubation period of 15 days, the Kawal matured and was taken out, cut into small irregular balls and was sun dried on a raised shelf for 5 days.

The dried Kawal balls were then ready for consumption as food in the form of stew.

2.7 Micro organisms of Kawal fermentation

After the first 3 days of incubation, the fermentation paste was found to be completely covered with white fungal growth. On transfer to laboratory media the fungus produced a white fluffy growth, filling up all the Petri dish and carrying black spores. It was identified as Rhizopus.

The bacteria there is one species which is always present in large dominating number. This bacterium is predominately found in all dried kawal samples collected from different localities of the Sudan. The bacterium has been tentatively identified as Bacillus subtilis.

2.8 Nutritional value

Cassia obtiusifolia leaves are certainly among the richest plant materials with respect to various nutritional component s of the human diet. Duke inflorescences, shoots, and sprouts of over 30 leguminous plant. It can be seen from his tables that the leaves of c.obtiusifolia have the highest calcium and riboflavin of all the legumes listed. More over the leaves of this plant rank second in iron and beta- carotene, and third with respect to ash and ascorbic acid. Those of c. obtiusifolia have the highest phosphorus, calcium, riboflavin and ascorbic acid levels.

Ash content of c.obtiusifolia leaves is generally very high compared to other plant.

Table 1: Composition of kawal and green leaves of cassia obtiusifolia

Component	Unite	Fresh green leaves	Dry kawal samples from the Sudan
Ash	g / kg DM	12.6	19.6
Crud protein	g / kg DM	24.3	26.2
Fat	g / kg DM	2.5	3.8
Crud fiber	g / kg DM	13.5	12.1
Na	g / kg DM	1.42	0.87
Ca	g / kg DM	3.85	4.13
P	g / kg DM	0.26	0.28
Mg	g /kg DM	0.3	0.42
Mn	g /kg DM	75	112
Fe	g / kg DM	534	82
Zn	g / kg DM	32	84

(adapted from Dirar*et.al* . 1985)

DM = dry matter.

Table 2: Amino acid composition of Kawal at different stages of fermentation

Amino acid ($g16g^{-1}N$)	Fresh green leaves	Leaf paste at end of fermentation	Juice separating at end of fermentation	Dry Kawal samples from the Sudan	FAO reference protein
Aspartic	12.1	5.6	4.2	7.7	-
Theonine	6.2	2.4	1.7	3.3	4.0
Serionine	4.6	2.2	1.4	2.8	-
Glutamic	13.6	5.9	4.9	8.2	-
Valine	7.5	6.6	8.1	6.4	5.0
Cystine	1.4	0.9	0.8	1.2	3.5 (Cys. + Met)
Methionine	2.1	1.8	3.0	1.5	-
Leucine	10.4	8.0	8.7	8.3	7.0
Phenyl	6.8	4.3	1.7	5.4	-
Histdine	3.3	1.4	0.8	2.0	-
Lysine	7.7	3.8	2.5	4.0	5.5

(adapted from Dirar *et al*., 1985)

2.9 Yoghurt

Yogurt is defined as the product being manufactured from milk with or without the addition of some natural derivative of milk such as skim milk powder; whey concentrates caseinates or cream with a gel structure that results from the coagulation of the milk protein, due to the lactic acid secreted by defined species of bacteria cultures.

2.10 Health benefit of yoghurt

The nutrient composition of yoghurt is based on the nutrient composition of the milk from which it is derived, which is affected by many factors, such as genetic and individual mammalian differences, feed, and stage of lactation, age, and environmental factor such as the season of the year.

Other variables that play a role during processing of milk including temperature , duration of heat, exposure t o light , and storage conditions, also affect the nutritional value of the final product .

These benefits are:

- Aids in immune function.
- Weight control.

Yoghurt can be recommended to the people with lactose intolerance, gastrointestinal disorders such as inflammatory bowel disease and irritable bowel disease.

2.10.1 Benefits of lactic acid bacteria in yoghurt on the gastrointestinal function and health

Yoghurt and (LBA) contribute to several factors that enhance the gut function and health: the make of gastrointestinal flora, the immune response a against pathogens.

2.11 Manufacturing of yoghurt

2.11.1 The main processing steps of yoghurt making

1. Milk standardization:

In yoghurt production we have to consider content should be standardized to the level preferred by the market and also the total solid is often being increased by adding dried skim milk, condensed milk or skim milk or liquid milk. This procedure gives high total solids and the increase in milk solids is to get a more firm coagulum.

2. Homogenization:

Homogenization treatment reduces the diameter of fat globules to less than 1mm and ensures uniform distribution the food matrix, thus considered as an important processing step especially for yoghurt with high fat content.

It results no distinct creamy layer on surface of the yoghurt and improves consistency of the yoghurt. The use of homogenization prevents fat separation (creamy) during fermentation or storage, reduces whey separation, and increases whiteness.

3. Heat treatment:

It is generally considered that the heat treatment of milk is an essential step in yoghurt manufacturing process that greatly influences the micro structure and physical properties of yoghurt.

Heat treatment has a number of beneficial effects as it will destroy the micro organisms present in milk or yoghurt mixture which can potentially interfere with the controlled fermentation process, will denature the whey

proteins that will give the final product a better body and texture, and will release the compounds in milk that stimulate growth of the starter culture micro organisms. In addition, it will help some ingredients to a achieve the re quired state to form gels and protein lactic, that affects the final texture and viscosity of the product while aid in removing dissolved oxygen in the milk and the starter culture growth as they are sensitive to oxygen .

4. Fermentation process (incubation)

After heat treat ment, the milk base is cooled to the incubation temperature used for growth of the starter culture an optimum temperature of the thermophilic lactic acid bacteria, such as Streptococcus subsp. thermophilus and Lactobacillus delbrueckii subsp. bulgaricus, is around 40-45c. Bacterial fermentation converts lactose into lactic acid, which reduces the PH of milk. During acidification of milk, the PH decreases form 6.7 to <-4.6.

5. Cooling:

When yoghurt has reached the desired PH (4.5-4.6), it will then often blast chilled to refrigerated temperatures (<10C) in order to stop the fermentation process and thereby stops further acid development.

2.12 Shelf life of yoghurt

The shelf life of fresh yoghurt may be only a couple of weeks for un protected operations and up to 6 weeks or more for well - operated, ultra clean operations and short, even if stored at low temperatures this may be due to the sanitary problems usually associated with it production and due to un hygienic handling of the product, which increases microbial contamination. The high microbial load of yoghurt, couple with the

packaging and storage conditions, and result in formation of off- flavors and undesirable physicochemical changes that lead to rejection of the product.

2.13 Factors affecting the quality of yoghurt

There are many factors affecting the quality of yoghurt but the most important factors are:

- Types and composition of milk.
- Heat treatment.
- Starter culture.
- Storage period of yoghurt and the additives in yoghurt.

2.14 Nutritional value of yoghurt

- Amount Per 1 container (170 g)
- Calories 100
- % Daily Value*
- Total Fat 0.7 g 1%
- Saturated fat 0.2 g 1%
- Polyunsaturated fat 0 g
- Monounsaturated fat 0.1 g
- Trans fat 0 g
- Cholesterol 9 mg 3%
- Sodium 61 mg 2%
- Potassium 240 mg 6%
- Total Carbohydrate 6 g 2%
- Dietary fiber 0 g 0%
- Sugar 6 g
- Protein 17 g 34%

- Vitamin A 0% Vitamin C 0%
- Calcium 18% Iron 0%
- Vitamin D 0% Vitamin B-6 5%
- Vitamin B-12 21% Magnesium 4%
- *Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

2.14.1 Proteins in Yogurt

Yogurt is a rich source of protein.

Plain yogurt made from whole milk contains about 8.5 grams of protein in each cup (245 g).

The protein content of commercial yogurt is sometimes higher than in milk, because dry milk is sometimes added to yogurt during processing.

Proteins in yogurt can be divided into two families, whey and casein, depending on their solubility in water.

Water-soluble milk proteins are called whey proteins, whereas insoluble milk proteins are called caseins.

Both casein and whey are of excellent quality, rich in essential amino acids, and have a good digestibility.

1.14.2 Casein

The majority (80%) of proteins in yogurt are in the casein family, the most abundant of which is alpha-casein.

Casein can increase the absorption of minerals, such as calcium and phosphorus, and promote lower blood pressure.

2.14.3 Whey

Whey is the smaller family of proteins found in milk products, accounting for 20% of the protein content in yogurt.

It is very high in branched-chain amino acids (BCAAs), such as valine, leucine and isoleucine.

Whey proteins have long been a popular supplement among bodybuilders and athletes.

In addition, consumption of whey protein may provide various health benefits, such as weight loss and lower blood pressure.

2.14.4 Fats

The amount of fat in yogurt depends on the type of milk it is made from.

Yogurt can be produced from all kinds of milk, whole milk, low-fat milk or fat-free milk. The majority of yogurt sold in the US is either low-fat or fat-free.

The fat content can range from 0.4% in non-fat yogurt to 3.3% or more in full-fat yogurt.

The majority of fat in yogurt is saturated (70%), but it also contains a fair amount of monounsaturated fat.

Milk fat is unique with respect to the diversity of fatty acids it provides, containing as many as 400 different types of fatty acids.

Ruminant Trans Fats in Yogurt

Yogurt contains a family of trans fats called ruminant trans fats or dairy trans fats.

Unlike trans fats found in some processed food products, ruminant trans fats are considered to have beneficial health effects.

The most abundant ruminant trans fats in yogurt are vaccenic acid and conjugated linoleic acid or CLA. Yogurt may contain higher amounts of CLA than milk.

CLA is believed to have various health benefits, but large doses via supplements may have harmful metabolic consequences.

2.14.5 Carbs

Carbs in plain yogurt are mainly in the form of simple sugars called lactose (milk sugar) and galactose.

The lactose content of yogurt is lower than in milk.

This is because bacterial fermentation of yogurt results in lactose breakdown.

When lactose is broken down, it forms galactose and glucose. The glucose is mostly converted to lactic acid, the substance that adds the sour flavor to yogurt and other fermented milk products.

Most yogurts also contain considerable amounts of added sweeteners, usually sucrose (white sugar), along with various kinds of flavoring.

As a result, the amount of sugar in yogurt is highly variable, and may range from 4.7% to 18.6% or higher.

2.14.6 Vitamins and Minerals

Full-fat yogurt contains almost every single nutrient needed by humans.

However, there are various types of yogurt and their nutritional value may vary substantially.

For example, the nutritional value of yogurt may depend on the types of bacteria used in the fermentation process.

The following vitamins and minerals are found in particularly high amounts in conventional yogurt made from whole milk:

- **Vitamin B12:** A nutrient only found in foods of animal origin.
- **Calcium:** Milk products are excellent sources of calcium, in a form that is easily absorbed.
- **Phosphorus:** Yogurt is a good source of phosphorus, an essential mineral that plays an important role in biological processes.
- **Riboflavin:** Also called vitamin B2. Milk products are the main source of riboflavin in the modern diet.

2.14.7 Probiotics

Probiotics are live bacteria that have beneficial health effects when consumed.

These friendly bacteria are found in fermented milk products, such as yogurt with live and active cultures.

The main probiotics in fermented milk products are lactic acid bacteria and bifidobacteria.

Probiotics have many beneficial health effects, depending on the species and the amount taken.

- **Enhanced immune system:** Studies indicate that probiotic bacteria may promote enhanced immunity.
- **Lower cholesterol:** Regular intake of certain types of probiotics and fermented milk products may lower blood cholesterol.

- **Vitamin synthesis:** Bifidobacteria can synthesize or make available many kinds of vitamins, including thiamine, niacin, vitamin B6, vitamin B12, folate, and vitamin K.
- **Digestive well-being:** Fermented milk containing bifidobacterium may promote digestive well-being and lessen the symptoms of irritable bowel syndrome.
- **Protection against diarrhea:** Probiotics may help treat diarrhea caused by antibiotics.
- **Protection against constipation:** Several studies suggest that regular consumption of yogurt, fermented with bifidobacterium, may reduce constipation.
- **Improved lactose digestibility:** Probiotic bacteria have been shown to improve the digestion of lactose, lessening the symptoms of lactose intolerance.

These health benefits may not always apply to yogurt, mainly because some types of yogurt have been heat-treated (pasteurized) *after* the probiotic bacteria were added.

In heat-treated yogurts, the probiotic bacteria are dead and do not provide any health benefits.

For this reason, it is best to choose yogurt with active or live cultures. (Deeth, 1981).

(http://www.healthline.com/nutrition/foods/yogurt#section1)

CHAPTER THREE

3. MATERIAL AND METHOD

3.1 Determination of crude protein

3.1.1 Principle

The method is based on the digestion of ptoteins and other organic food components in the sample with sulphuric acid in the presence of catalyst e.g. sodium or potassium sulphate to release nitrogen from protein and retain it as ammonium salt. Ammonia gas is liberated upon addition of excess alkail(cocentrated sodium hydroxide) and is distilled into aboric acid solution to from ammonium-borate complex . The ammonia liberated from the complex is titrated with standardised hydrochloric acid . The amount of nitrogen in the sample is determined from the milligram equivalent of the acid used . Crude protein is determined by multiplying the nitrogen content with a conversion factor specific to the food matrix .

3.1.2 Reagent

• Sulphuricacid , concentrated .

• Catalysts: potassium sulfate and or copper sulphate with or without selenium dioxide.

• Sodium hydroxide solution , 50% weight 500g sodium hydroxide dissolve in water and make up to1Lwith H2O.

• Boiling chips.

• Ammonium sulphate .

• Hydrochloric acid ,0.1N standard solution.

• Standardization of HCL solution stated in 6.6.

• Methyl red / bromcresol green indicator solution.

• Boric acid solution ,4% with indicator.

3.1.3 Apparatus

1-Kjeldahl and other commercial system .The system consists of 3 units :

• Digestion unit .

• Distillation unit .

• Titration unit .

2- Digestion tubes .

3- Erlenmeyer flask,250ml , 500ml .

4- Magnetic stirrer and magnetic bar .

5- Drying oven .

6- Balance, analytical, 200g capacity with 0.1mg sensitivity .

3.1.4 Procedure

- Preparation of sample: grind .
- Analysis .
- Blank : include 2 reagent blanks(contaning all reagent used in nitrogen analysis except the sample) in every batch of analysis to subtract reagent nitrogen from the samplenitrogen .
- Test sample.
- Thaw out sample to room temperature and mix the sample thoroughly .

- Weight induplicate 2-10g sample (depending on the nitrogen content of the sample) into the digestion tube .
- Add 5-7g catalyst and 1glass bead to prevent solution from bumping and 10-20ml sulphuricacid .
- Place digestion tube in the digester. Digest mixture initially at low temperature to prevent frothing and boil briskly until the solution is clear and is free of carbon or until oxidation is complete .
- Continue digestion until a clear digest is obtained.
- Heat for another hour after the liquid has become clear to complete breakdown of all organic matter.
- Place 250-500ml erlenmeyer flask containing 50ml of 4% boric acid with indicator as reseiveron the distillation unit.
- Add 500ml of water and 70ml of 50% sodium hydroxide to the digest s and syartdistillation .
- Distill untill all amonia has been released or approximately 150ml distillate is obtained.
- Lower the reciver flask so that the delivery tube is above the liquid surface and coctinue the distillation for1-2minutes.
- Finally rinse the delivary tube with water and allow the washings to drain into the falsk .
- Titrate the distillate with the standardized 0.1 N hydrochloric acid until the first appearanceof the pink colour.
- Record volum of acid used to the nearest 0.05ml.

3.1.5 Calculation

N(g%) = (ml 0.1N HCL sample -ml 0.1N HCL blank)×0.0014×NHCL×100÷Weight of sample

Protein (g per 100g) = %total nitrogen×appropriate nitrogen conversion factor

3.2 Determination of total fat

3.2.1 Principle

The sample is hydrolyzed by hydrochloric acid at 70-80% C. Protein if any can be dissolved in the acid, crude fat is then manually extracted by di ethyl and petroleum ether. The solvent id removed by evaporation and the oil residue is dried and weighted .

3.2.2 Materials

• Petroleum ether (boiling point 35-60C).

• Ethyl alchohol 95%.

• 4N hydrochloric acid.

• Diethyl ether , free from residue on evaporation.

3.2.3 Apparatus

• Round flat bottom flask or beaker.

• Thimple.

• Cotton wool.

• Condenser.

• Extraction glassware (separating funnle or Rohring tube Majonnier tubes or equivalent extracting container).

• Glass funnel.

• Hot air oven.

• Cylinder.

• Water bath.

• Desiccator.

• Analytical balance.

• Filter paper.

3.2.4 Procedure

Place 2g dried sample(W1) in a250ml erlenmeyer flask or extraction tube, add 2 ml alchohol . Stir to moisten all particles (moistening of sample with alchohol prevents lumping on addition of acid).

Add 10 ml of diluted 4N HCL and mix well. Set the flask on the heater and reflux for 30 min . If the tube is used , place the tube in water bath held at 70-80C and stir at frequent intervals until sample is completely hydrolysed (usually 30-40 min). Add 10 ml alchohol and cool.

If the hydrolysis has taken place in aflsk, transfer the digested mixture to extraction glassware. Rinse the flask and pour into the extraction tube with 25 ml diethyl etherin three portions.

Close the tube with cork and shanke vigorously for one min. Add 25 ml petoleum ether and again shak vigorously for one min. Let stand until upper liquidis practically clear.

Transfer as much as possible of the ether fat solution into a pre weight 125 ml flask by filtering it through a funnel containing a plug of cotton packed firmly in the steam part. Allow free passage of ether into the flask.

Before weighting the flask , dry it in drying oven at 100C and then let cool in a disccator and weight(W2).

Repeat extraction of the liquid sample remaining in tube twice using the same solvent. Each time , transfer the clear ether solutions through the same funnel into the same flask. When finished, rinse inside and outside of the funnel into the same flask.

Evaporate solvents completely on a water bath at 70-80C.

Dry fat in an ovenat100+-5C until constant weight is obtained.

Allow the flask to cool in a disiccator and weight(W3).

3.2.5 Calculation

Total fat(g/100g) = (W3-W2)×100÷W1

Where:

W1= weight of sample.

W2= weight of dried flask before fat extraction.

W3= weight of dried flask after fat extraction.

CHAPTER FOUR

4. RESULT AND DISCUSSION

Table 4. 1: This table complex the sensory evaluation in three sample of kawal with yoghurt:

Sensory evaluation	Mean	Stander deviation
Color A	3.7273	1.0090
Color B	4.0909	0.8312
Color C	4.1818	0.4045
Texure A	2.7273	0.7862
Texure B	2.6374	1.1201
Texure C	3	0.8944
Taste A	3.818	1.079
Taste B	4.182	1.079
Taste C	4.091	1.136
Flavour A	3.7273	1.0090
Flavour B	3.4545	0.8202
Flavour C	4.9091	0.3015
All over acceptable A	3.818	0.982
All over acceptable B	4.181	1.079
All over acceptable C	3.636	1.120

If the high percentage of kawal in yoghurt the less acceptable product was , but if it was a large porportion of yoghurt was un acceptable .

Table 4. 2: This table below shows the analysis of protein and fat in kawal:

Parameter	**%**
Fat	5.23
Protein	9.62

In this experiment we found that the protein cotent in kawal was high and could compensate for the lack of protein.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5. Conclusion

The results of sensory evaluation that Yoghurt containing more kawal were the most unacceptable and the best nutritional value.

Add a larger quantity of kawal that effect in the taste and flavour.

5.2 Recommendation

Add additives to the kawal or treat the workers so as to over shadow the odours , add flavours , because it contains high nutritional value of proteins , fats, minerals and other food important for human as it is a cure for many disease .

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