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Research Article

Proximate Composition of Whey from South West Nigeria

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ABSTRACT
Whey samples from major small scale and individual soft cheese producing areas of South West Nigeria were subjected to analysis for their proximate compositions, and their proximate composition related to their functional properties in terms of acid stability, emulsification, aeration, foaming ability and gelling ability. The results of the analysis revealed that the protein content ranges from 0.36% to 0.46%, indicative of the ability of whey to produce foam, gel on heating, resist shear and denaturation on heating. Fat content obtained for each of the 4 different samples of whey is 0.26%, indicative of emulsification property and reduced foaming ability. Lactose content ranges from 3.98% to 4.06%. Sugar is an important factor in gel formation when used in combination with pectin. Ash content ranges from 0.84% to 0.95%, indicative of high ionic strength, the calcium content being an important factor in gel formation with low methoxyl pectin which forms thermo reversible gels with calcium. Lactic acid content ranges from 0.27% to 0.36%, indicative of acid coagulation for the manufacture of the cheese. pH in all the 4 different samples of whey is 5.9, an indication of acid stability and a condition necessary for gel formation. There were no significant differences ($p<0.05$) between the samples from the 4 different locations, in their moisture, protein, fat, lactose, ash and acidity contents when subjected to statistical analysis.
***Key Words**: Whey, Proximate Composition, Functional Properties.*

INTRODUCTION

Whey is the green yellow translucent watery portion of milk remaining after milk coagulation and removal of the curd. It is a byproduct of cheese manufacture and is sometimes regarded as a waste and constitutes a major problematic disposal if not processed further to valuable products [1]. Milk curdles when its acidity rises and the curdling is complete when it reaches its isoelectric point which is pH 4.7. Success in cheese making is dependent on this level of acidity in milk [2].

The differences in the composition of milk used in cheese manufacture influences the composition of the manufactured cheese and whey. The type of bacteria used in the curdling of the milk also influences the type of cheese and whey produced [2]. Cheese can be classified into two broad groups namely, soft and hard cheese. Hard cheese has most of the protein coagulated, while Soft cheese, a considerable amount of the protein remains behind in the whey [2].

There are two types of whey, sweet and acid whey depending on the coagulation method used. When acid coagulation is used, acid whey is produced, and when enzymatic coagulation is used, sweet whey is produced [1].

The composition of the whey is also determined by the method of coagulation used [1]. Whey contains high quality and nutritious dairy proteins like alpha-lactoglobulins, beta-lactoglobulin, bovine serum albumin and immunoglobulin which are good for healthy living [3].

Whey can be converted into powdered products by spray drying to produce powdered whey protein concentrates ranging from 35% to 90% which are important ingredients in food processing because of their various functional properties which include: acid stability, gelling, film formation, foaming, emulsification and aeration [3, 4, 5]. Whey protein isolate is a product containing not less than 90% protein and is produced from whey. In its manufacture, ion exchange is used as pretreatment prior to ultrafiltration and subsequent spray drying.

Whey proteins are excellent source of all essential amino acids and are easily digested. Some foods lack adequate amounts of certain amino acids (e.g. wheat flour, and rice are both low in lysine, while soy is low in methionine). Foods consumed together can balance each other by balancing the deficits and surpluses of essential amino acids. Thus, whey proteins have found use in food fortification and

supplementation. Whey proteins also contain high levels of branched chain amino acids_leucine, isoleucine, valine, which are considered useful in sport drinks for muscle building.
Whey protein can also be considered useful in infant and external formular, weight gain and weight reduction diets, protein fortified fruit juices and other health foods and drinks.
The objective of this work is to determine the proximate composition of whey samples from the various cheese production areas in Ogun state with a view to relating the proximate composition to the functional properties of whey protein; classifying the type of whey based on the method of coagulation; to evaluate their quality by comparing their proximate composition in literature and to provide a reference material for those interested in converting whey into different whey powdered proteins, which can serve as ingredient to various food industries, as such information are lacking at the moment.

MATERIALS AND METHODS

Cheese producing areas were identified in Ogun state, namely: Oja Odan, Oko Yanrin, Idogo, and Itori. Whey samples were collected from these 4 different locations where cheese production is prominent. The samples were kept under refrigerator at 5^0C until required for analysis.

Analytical Procedure

The proximate and chemical analyses of samples were carried out using standard procedures as follows: Moisture content was determined by the oven method as described by Pearson, 1976 [6]. Ash content was determined on a 10g sample by incinerating in a muffle furnace at 550°c for 4hrs, and followed by coiling at room temperature (25°c). The remaining ash was weighed and the ash content calculated [7]. The fat content was determined using the Rose _Gottlieb process [8]. Lactose content was determined by the spectrophotometric method [9]. The crude protein content was determined by the Kjeldahl method [7] and the crude protein calculated by multiplying the nitrogen content by 6.38. The total acidity of the whey samples was determined as % lactic acid using the titration method as described by Pearson, 1976 [6].The pH of the whey samples were also determined using a digital pH meter (Model pH 100 and pH 110).

RESULTS

The results of proximate composition of the whey samples from 4 different locations in Ogun state are shown in Table 1.The major nutrients in whey are water, protein and lactose. Table 2 shows the physical constants of whey samples collected from 4 different locations in Ogun state. The physical constants under consideration are PH, total acidity (measured as % lactic acid). Table 3 shows the general composition of whey.

Table 1. Proximate Composition of Whey from four different locations in Ogun state S.W Nigeria

Source	Protein %	Fat %	Ash %	Lactose %	Moisture %
Oja Odan	0.40 ± 0.05	0.26 ± 0.00	0.92 ± 0.01	4.01± 0.20	92.0 ± 0.00
Oko Yanrin	0.34 ± 0.02	0.26 ± 0.00	0.87 ± 0.03	3.98 ± 0.30	92.0 ± 0.00
Idogo	0.46 ± 0.02	0.26 ± 0.00	0.95 ± 0.02	4.03 ± 0.20	92.0 ± 0.00
Itori	0.38 ± 0.02	0.26 ± 0.00	o.84 ± 0.02	3.88 ± 0.20	92.0 ± 0.00

Values are means of three determinants with standard deviation. S.W= Southwest

DISCUSSION

Moisture content of the whey samples collected from the different locations in ogun is 92%. This value is similar to the value recorded in literature and accounts for whey water – solubility. Protein content ranges between 0.34% and 0.46% for the four different samples. This is the portion of whey responsible for its gelling, foaming and increased whipping properties [10, 11, 12].

Table 2. Physical Constants of Whey from four different locations in Ogun state S.W Nigeria

Source	pH	Acidity (%Lactic acid)
Oja Odan	5.90	0.27
Oko Yanrin	5.90	0.36
Idogo	5.90	0.35
Itori	5.90	0.32

Values are means of three determinants.

Table 3. General Proximate Composition of Whey

Constituent %	Sweet whey	Acid whey
Water	93-94	93-94
Dry matter	6-6.5	5-6
Lactose	4.5-5.0	3.8-4.3
Protein	0.6-0.65	0.6-0.65
Lactic acid	Traces	Up to 0.8
pH	6.2-6.4	4.6-5.0

Source: *Ziegler, G.R and Faegedng, E.A (1990)*

However the value is low when compared with the general composition of whey as recorded in the literature.

Fat content obtained for the 4 different samples of whey is 0.26%, this is the portion of whey responsible for foam stability in product [13]. The fat content of whey depends on the fat content of the milk cheese. High fat content in the cheese milk leads to more fat loss into the whey, more so when the cheese milk has not been homogenized or subjected to microfiltration [13].

Ash content obtained ranges from 0.84% to 0.92% for the 4 different samples of whey. This value is greater than the value in literature. This the portion of whey responsible for the ionic strength and rich in calcium, an important factor in gel formation with low methoxyl pectins.

Lactose content obtained ranges from 3.88% to 4.03 for the 4 different samples of whey. This value agrees with the value for acid coagulated whey (3.8% to 4.3%). However, the whey samples under study are not coagulated by enzymes rennet but by leaf extract.

Lactic acid content obtained ranges from 0.27 to 0.35% for the 4 different samples of whey. The value confirms that the whey samples are acid coagulated. The P^H of the 4 different whey samples is 5.9, and is responsible for the acid stability and gelling property of whey. This also confirm that the whey samples are acid coagulated. There were no significant difference ($p<0.05$) in moisture content, lactose content, ash content and acidity among the samples from the 4 different locations when subjected to statistical analysis using the t-test [14].

Generally, the proximate composition of a particular whey will determine the food application that are possible with that whey [1, 3, 4, 5, 11, 12, 13].

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