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COMPARATIVE STUDY OF THE EFFECTS OF WHOLE MILK AND SOYMILK EXTENDERS ON SEMEN QUALITY AND PERIOD OF STORAGE.

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Abstract

The objective of this study was to test the effect of two different diluents on the motility of goat semen stored at refrigerator temperatures. To achieve this objective, six West African dwarf bucks aged 12-24 months were used. Semen was collected every other day for a period of seven days by electro-ejaculator method. The ejaculated semen was extended using two diluents containing whole milk and soy-milk respectively. The extended semen was stored for a period of four days in refrigerated temperature (4°C). The semen was evaluated for semen colour, semen volume, sperm concentration, sperm motility, normal spermatozoa and sperm abnormality for a period of four days. The results indicated that storage days and type of extender were not significant ($p > 0.05$) throughout the period. It was concluded that goat semen can be preserved for 96 hours in soy-milk extender under refrigerated temperature (4°C) without any negative effect on its fertilization potential.

Key words: Whole milk, Soy-milk, Spermatozoa and Semen.

Introduction

The seminal plasma is composed of number of organic and inorganic compounds; the major organic ion found in seminal plasma is bicarbonate produced by the Vesicular glands and functions as a buffering agent which regulates pH changes of semen. Every year, about 19million inseminations are performed in the world and over 85% of these are done on the day or the day after semen collection in order to forestall any adverse effect on fertilization potential (Johnson *et al.*, 2000; Gadea, 2003). Artificial insemination (AI) has been postulated to have the potential of increasing productivity, enhance bio-security and aiding the genetic management of animals for either Agricultural or conservation purposes (Lloyd, 2007). Extenders are certain ingredients added to ejaculated

semen to sustain and protect the spermatozoa thereby preserving its fertility until they are used for insemination. Honey, though contains high level of metabolizable energy in form of glucose and fructose and has antibacterial activity against micro organisms has been used to provide energy but with reduced fertility (Al Waili, 2004). It was recorded that goat semen can be preserved for 24hours in sodium citrate under refrigerator temperature (Udeh and Oghenesode, 2011).

Extension of semen helps to extend the shelf life apart from increasing the volume and number of female animals that could be inseminated per dose. Extenders are the aqueous solution used to increase the volume of the semen while the functional characteristics and the fertility rate of the spermatozoa are preserved. The extender

performs this function by supplying nutrient glucose required for spermatozoa metabolism, protecting against cold shock, controlling the pH and osmotic pressure of the medium and inhibiting microbial growth (Gadea, 2003). Extended semen stored at 5 degree centigrade (refrigerated semen) is beneficial because spermatozoa metabolism rate is reduced (Gadea, 2003). Also, it is cheaper than freezing semen and appropriate when insemination is intended up to 72 hours from collection time (Foote, 2002).

Spermatozoa, by nature, are catabolic cells. This means that in the metabolic processes they deteriorate as they use stored energy. With time, they age and slowly die off until all cells are immotile and incapable of fertilization. Likewise, semen subjected to adverse environments will irreversibly deteriorate and become useless. Because sperm have little or no anabolic or healing capacity, anybody working with any stage of semen processing must be attuned to the potentially harmful environments in which semen is placed. The main objective in semen processing is to minimize the catabolism of semen so that the quality of thawed semen is similar to that which was originally ejaculated. By doing this, semen can be packaged so that more than the minimum threshold number of viable cells are available in the oviducts. The long list of extenders includes nearly every imaginable kind of medium from cow's milk, to coconut milk, to tomato juice, to various exotic mineral waters. The survival of spermatozoa during freezing and thawing is affected by many factors, including the composition of the cryodiluent (Curry, 2000; Yoshida *et al.*, 2000; Watson, 2000; Leibo and Songsasen, 2002).

Generally, when semen is extended and stored above 0°C, sperm cell survival is of a few days duration and sperm fertilizing ability cannot be preserved for more than a

few days. Sperm cell survival is generally longer than fertilizing capacity and the former cannot be used as an indication of the latter. This was because refrigerator temperature helps to stop metabolic process of stored liquid semen which resulted in the utilization of nutrients such as fructose by the sperm cells (Aboagle and Terada, 2003). This observation was in line with the reports of Bayemi *et al.* (2010) that refrigerator temperature recorded the highest viability of stored bull semen with a general motility of 44.50% over the whole experimental period.

Most, if not all, semen is preserved in a frozen state. In order to accomplish this goal, suitable extenders must be used. An ideal extender has to meet certain requirements:

- a) Provide nutrients as a source of energy;
- b) Contain constituents that provide protection against the harmful effects of cooling and freezing;
- c) Provide a buffer to prevent shifts in pH as lactic acid is formed;
- d) Maintain the proper osmotic pressure and electrolyte balance,
- e) Contain antibiotics that inhibit bacterial growth,
- f) Substantially increase the volume of semen so that multiple inseminations can be performed; and
- g) Provide an environment in which metabolic activities of the sperm can continue. Most extenders for liquid or frozen semen have been either egg yolk or milk or a combination of the two as a basic ingredient. The primary benefit derived from fresh egg yolk is protection of the sperm cell against cold shock by yolk lipoprotein and lecithin. The milk protein, caseins, has been established as the agent responsible for prevention of cold shock.

Goat semen has been diluted in saline, sodium citrate or skim milk. Of these extenders, only skim milk heated at 95°C for

10 minutes satisfactorily preserved the fertilizing capacity of goat spermatozoa. Cow's milk has been used as an extender in routine artificial insemination of goats with good fertility results. A skim milk glucose-glycerol extender has also been used to freeze goat semen.

There are two schools of thought regarding the use of egg yolk as a component of a goat semen extender. Semen diluted with egg yolk has resulted in acceptable conception rates for some workers. In 1,007 goats inseminated with sodium citrate glucose-yolk-glycerol extended semen, conception rates were 60 and 92% with frozen thawed and fresh semen, respectively.

Other investigators believe that egg yolk is toxic to the goat spermatozoa. An enzyme (phosphotidase) produced by the bulbourethral glands of the male goat catalyses the hydrolysis of lecithins in egg yolk to fatty acids and lysolecithins, which are toxic to the spermatozoa. The presence of phosphotidase in the seminal plasma of the goat means that media containing egg yolk cannot be used for semen extension.

Seminal plasma has been blamed as a limiting factor of goat semen freezability and fertility. Washing goat spermatozoa in a physiological solution improved the percentage of motile sperm in fresh ejaculates. Post-thaw motility of spermatozoa was also increased. Recent evidence supports the idea that egg yolk low-density lipoproteins may prevent the binding of deleterious major seminal plasma proteins on the sperm surface that would cause lipid efflux (Manjunath *et al.*, 2007).

Egg-yolk-Trish has been reportedly used as an extender and has shown improved benefit on sperm cryopreservation, a good protecting of the plasma membrane and acrosome against temperature related injury, in association

with the other components (Amirate *et al.*, 2004). The use of egg-yolk involves hygienic risk, Interference with fertility and poor microscopic examination. Therefore replacement of egg-yolk with a plant-based component with protective effects on spermatozoa would be advantageous. The effect of soya milk-based extenders has been reported on delusion and liquid preservation of Murray buffalo bull semen at 5°C for 72 hrs in comparison with conventional egg yolk-tris extender ().

Semen Extension Rate

The objective of extending semen is to provide an appropriate volume of inseminate with a sufficient number of sperm to give high fertility without wasting sperm. Sperm concentration of the ejaculate varies from 2 to 6.5×10^9 sperm/ml. Highest fertility in ewes was reported for sperm suspension frozen at a concentration of 666×10^6 sperm/ml. Another worker inseminated goats with 1×10^9 sperm/ml and reported fertility. Semen of rams and bucks is routinely extended immediately after collection at 37°C and cooled slowly to prevent cold shock, resulting in sperm damage. Lipoprotein and lecithins, found in egg yolk, and milk, provide protection from cold shock when added to the semen before cooling. Buck semen was extended in sterilized tubes (Sule *et al.*, 2007). The optimum cooling rate is one that prevents cold shock but is fast enough to maintain healthy, viable sperm cells. Extended buck semen can be used frozen thawed, chilled or fresh (i.e. non-refrigerated), but when fresh semen is used, it offers better fertility and conception rate. In addition, Blash *et al.* (2000) stated that the process of freezing and thawing of goat semen reduces the percentage of live sperm cells and acrosomal integrity. To meet the need of A.I., many extenders have been used. These include egg yolk- phosphate, skim milk and orange juice

(Sule, 2007). Semen cooled at 5°C in Glycerol sperm extender before freezing, increase due to the presence of sperm during ice formation, sperm protective glycerol "buffering" damage minimize.

T In addition, it has been studied. Some results before cooling at 4°C. Significant glycerol phase, glycerol level of extended semen. One worker added 14% glycerol. Extended semen at 4°C because reduced motility than fresh insemination. collection. Soybean legume is used for its edible oil. Fat-free primary, animal feed. Tradition soybeans tofu and soy sauce. temped, 100°C of soy a

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(Sule., 2007). After extension, semen is cooled at 5°C at approximately 0.5°C/min. Glycerol is added to extenders to protect sperm against the detrimental effects of freezing. It has been suggested that the increase in intracellular salt concentration due to the removal of water from the cell during ice formation is a major cause of sperm damage during freezing. The protective action of cryo-protectants, such as glycerol is largely attributed to their salt "buffering" capacity; thus, electrolytic damage as the water freezes out is minimized.

The time, temperature, rate of addition, and concentration of glycerol have been studied with many conflicting reports. Some researchers have added the glycerol before cooling (i.e., at 30°C) and others at 4°C. Since cryo-protective activity of glycerol occurs during the crystallization phase, glycerol should be added at 4°C. The level of glycerol is generally 4-6% in extended ram semen (Okukpe et al., 2012). One worker has used 6-9%, and another added 14% glycerol to freeze goat semen. Extended semen stored at 5 degree centigrade (refrigerated semen) is beneficial because spermatozoa metabolism rate is reduced (Gadea, 2003). Also, it is cheaper than freezing semen and appropriate when insemination is intended up to 72 hours from collection time (Foote, 2002).

Soybean (*Glycine max*) is a species of legume native to East Asia, widely grown for its edible bean which has numerous uses. Fat-free (defatted) Soybean meal is a primary, low-cost source of protein for animal feeds and most prepackaged meals. Traditional non fermented food use of soybeans include soymilk, and from the later tofu and tofu skin. Fermented foods include soy sauce, fermented bean paste, natto, and temped, among others. The main producers of soy are the United States 35%, Brazil

27%, Argentina 19%, China 6% and India 4%. Soymilk is made from soaking, grinding and boiling Soybeans in water and it is a very nutritious drink. Soymilk is naturally high in essential fatty acids, proteins, fibre, vitamins and minerals. The Nutrients provide energy and keep the body functioning at its optimum level.

In recent years, there has been a growing trend in many regions of developing world to identify potential important extenders among the crops by product and animal by products. Soybean (*Glycine max*) is a food-crop commonly grown in most parts of Nigeria. It is locally use for producing Soymilk, Soy-cheese, Soy-flour, infant food, vegetable oil, animal feed etc. Soymilk in food value is comparable with ordinary milk and it is very easily digestible. Soymilk is readily available and relatively cheaper than the known regular extender.

Different Semen Usage

- Semen can be used as liquid semen, directly on the same day collected; one ejaculate can serve between 3 to 5 does. If kept at body temperature, the semen may be good for three hours.
- Semen may be stored for 24 to 48 hours by placing the collection tube in a container of water and putting this unit in a refrigerator. No diluter is needed, although plain egg yolk can serve as simple extender to double the number of does that can be serviced.
- Semen that is to be stored for longer periods of time must be mixed with a diluter and very carefully frozen (Leboeuf et al., 2000). A commercially prepared diluter extender, such as Ortho Semen Diluter is desirable, although plain milk can be used successfully also. Semen can be stored in diluents

such as the Illini Variable Temperature (IVT) diluents, which have been reported to be able to preserve high fertility of semen for over seven days. The IVT diluents is composed of several salts, sugars and antibacterial agents and gassed with CO₂ (Balk *et al.*, 2003).

It is clear from literatures that investigation of the comparative performance of the West African Dwarf Buck spermatozoa in soymilk at 5 degree centigrade has not been studied. The objective of this study was to determine the effects of Soymilk extenders on sperm quality of West African Dwarf Buck semen in refrigeration temperature.

Materials and method

Experimental site

The study was carried out at the Small Ruminant Unit of the Animal Production Department, Faculty of Agriculture, University of Ilorin, Ilorin, Kwara State, Nigeria.

Treatment and Extraction of Soymilk

Soybean (*Glycine max*) seed was used for producing the soymilk. Soymilk was made by soaking, grinding and boiling soybeans with deionized water. The soymilk

Table 1: Composition of Extenders Used

Ingredients	Soymilk yolk extender(ml)	Whole milk yolk extender(ml)
Egg yolk	20	20
Soymilk	100	-
Whole milk	-	100
Sodium citrate	2.9	2.9
Penicillin	0.5	0.5
Streptomycin	0.5	0.5

Semen Collection

Semen was collected every other day for a period of seven days by electro ejaculator method (Okukpe *et al.*, 2000; Oyeyemi *et al.*, 2000). This experiment took place between April and June 2012. Prior to

sample (0.25kg) was soaked for 18hours in excess deionized water (750kg) to remove the bitter taste. It was washed and milled with less water, this was later repeated with the addition of deionized water (500ml).The mixture of the soybean and water was stirred and sieved using a clean cloth. The soymilk was collected and refrigerated.

Management of Animals

Six West African Dwarf bucks of the age between 1 to 2 years were purchased within Ilorin metropolis. These bucks were quarantined for 14days. During this period, the bucks were given oxytetic, vitamin and ivomec injection to relieve them from stress, external and internal parasites. The bucks were vaccinated against *peste des petite ruminantium* (PPR) infection before the commencement of the experiment.

Preparation of Extenders

Two types of extenders were prepared using whole milk and soymilk. Whole milk glycerol extender was the established extender while the soymilk extender was the test extender with soymilk component. The extenders were prepared close to the time of use.

semen collection, the buck prepuce was properly cleaned; the rectal probe was lubricated with petroleum jelly and gently inserted into the rectum by slow rotating movement with both electrodes down. The buck was held in a restraining crate. The

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electro-ejaculator was then plugged to a source of electricity and switched on. Voltage was applied to the animal by rotating the knob of the variable control.

Pre-Extension Evaluation of Semen

Immediately after semen collection, a drop of semen from buck's prepuce was put on clean warm glass slide. This drop of semen was used to assess mass activity of the semen and the values recorded. Volume of collected semen was also recorded. Microscopic evaluation of semen concentration and motility was quickly done by haemocytometer counts and the values recorded. Morphology of semen was also studied by staining sperm cells with Eosin-Nigrosin stain as described by Okukpe et al. (2001). In each trial, prior to semen extension, volume, motility and concentration of spermatozoa were quickly assessed and the values recorded as pre-extension sperm parameters.

Semen Evaluation

The semen was taken to the laboratory in a flask containing warm water (37°C). The volume of the semen was recorded with the aid of a graduated cylinder. The colour, volume, concentration, motile count, motility and the morphology rate of the semen were determined; semen was placed on a slide to examine the motility, covered with a cover slip and examined under a microscope. The concentrations of the sperm cells were determined using a photometer (Peterson et al., 2007).

Semen Extension

Buck semen was extended in sterilized tubes (Sule et al., 2007). The semen was extended by dispensing 0.1ml semen into 0.5ml extender previously kept at 37°C. The extended semen were evaluated for motility every 24hours for 4days. After necessary semen samples have been taken for analysis remainder was processed for

storage. The test tubes of freshly collected semen were placed in water bath at 37°C. Processing started within 10minutes of collection after it had been evaluated. Previously prepared extenders were placed in the water bath to bring their temperature to the same level as the semen (equilibration). Each extender was divided into four equal parts. The semen + extenders were then placed along with the water bath in the refrigerator and allowed to cool to about 5°C by leaving it for two hours depending on the volume after which they were mixed. A dilution rate of 0.1ml semen to 0.5ml extender was used.

After processing the extended semen was packed in labeled bottles and stored in the refrigerator for four days before it was re-evaluated. pH of the extender was monitored and recorded at every 24hours of storage.

Statistical Analysis

All parametric data were subjected to 2×4 factorial analysis in a Completely Randomized Design (Steel and Torrie, 1980). Significant means were separated using Duncan multiple range test (Duncan, 1955).

Results

The effects of extenders and storage days on the semen characteristics, viz: Concentration, motile count, percent motility, percent normal, percent head defect, percent neck defect, and percent tail defect (Table 2). The mean sperm concentration count for whole milk and soy-milk extenders were $70.0 \times 10^6/\text{ml}$ and $65.0 \times 10^6/\text{ml}$ for day one, $67.0 \times 10^6/\text{ml}$ and $60.0 \times 10^6/\text{ml}$ for day two, $67.0 \times 10^6/\text{ml}$ and $58.0 \times 10^6/\text{ml}$ for day three and $67.0 \times 10^6/\text{ml}$ and $55.0 \times 10^6/\text{ml}$ for day four respectively. There were no significant difference ($P < 0.05$) between the extenders.

The mean motile count for whole milk and soy-milk extenders were $50.0 \times 10^6/\text{ml}$ and $43.0 \times 10^6/\text{ml}$ for day one,

45.0 $\times 10^6$ /ml and 38.0 $\times 10^6$ /ml for day two, 47.0 $\times 10^6$ /ml and 32.0 $\times 10^6$ /ml for day three and 30.0 $\times 10^6$ /ml and 25.0 $\times 10^6$ /ml for day four respectively. There was no significant difference ($P < 0.05$) between the extenders.

The mean percent motility for whole milk and soy-milk extenders were 71.0% and 66.0% for day one, 66.0% and 63.0% for day two, 60.0% and 55.0% for day three and 45.0% and 46.0% for day four respectively. There was no significant difference ($p < 0.05$) between the extenders.

The mean percent normal for whole milk and soy-milk extenders were 60.0% and 57.0% for day one, 54.3% and 63.0% for day two, 45.0% and 40.0% for day three and 35.0% and 31.0% for day four respectively. There was no significant difference ($p < 0.05$) between the extenders.

The mean percent head defect for whole milk and soy-milk extenders were 15.0% and 16.0% for day one, 16.0% and 17.0% for day two, 20.0% and 21.0% for day three and 23.0% and 24.0% for day four respectively. There was no significant difference ($p < 0.05$) between the extenders.

The mean percent neck defect for whole milk and soy-milk extenders were 5.00% and 6.00% for day one, 4.00% and 4.00% for day two, 5.00% and 7.00% for day three and 7.00% and 8.00% for day four respectively. There was no significant difference ($p < 0.05$) between the extenders.

The mean percent tail defect for whole milk and soy-milk extenders were 20.0% and 21.0% for day one, 25.0% and 27.0% for day two, 30.0% and 32.0% for day three and 35.0% and 37.0% for day four respectively. There was no significant difference ($p < 0.05$) between the extenders.

In composition of whole milk and soy-milk showed in Table 1, the protein content of soy-milk is 40.0% while that of whole milk is between the ranges of 24.5-27.0% which indicates that the protein content of

soy-milk is significantly higher than that of the whole milk. In this case, soy-milk extender can be used in replacement of whole milk as an extender when processed properly.

The cholesterol content of whole milk has been reported as 26.0% - 40.0% while that of soy-milk is 20.0% (Okukpe et al., 2012) which indicates that the lipid content of whole milk is higher compared to that of soy-milk. The high cholesterol shows the level of saturated fat which can affect the spermatozoa since saturated fat is bad; mean that whole milk can cause limitation to semen quality. The unsaturated fat present in soy-milk has made it good for semen extender.

The carbohydrate content of whole milk falls within 36.0% and 38.5% while that of soy-milk is 35.0% which shows that there is no pronounced difference in the carbohydrate content of both milk as we observed in protein and lipid contents.

Ash content for whole milk ranges within 5.5%-6.5% while that of soy-milk is 4.9% which shows that there is negligible difference in the ash content of whole milk and soy-milk. There is moisture present in whole milk but absent in the soy-milk composition. The above results showed that soy-milk is good for extending semen quality.

Discussion

As shown in Table 2, characteristics of semen were increased at increasing level and decreased at decreasing level of both the whole milk and soy-milk as extenders respectively. This means that insemination of doe with semen preserved in the whole milk and soy-milk extenders could favourably lead to effective fertilization, and hence conception.

Table 2: E

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Table 2: Effect of Extenders and Storage Days on Spermatozoa Characteristics

SEMEN PARAMETERS	EXTENDERS	DAYS OF STORAGE				±SEM
		1	2	3	4	
CONCENTRATION ($\times 10^6$ /ml)	Whole milk	70.0	67.0	67.0	67.0	±2.91
	Soymilk	65.0	60.0	58.0	55.0	
MOTILE COUNT ($\times 10^6$ /ml)	Whole milk	50.0	45.0	47.3	30.0	±2.13
	Soymilk	43.0	38.0	32.0	25.0	
MOTILITY (%)	Whole milk	71.0	66.0	60.0	45.0	±3.67
	Soymilk	66.0	63.0	55.0	46.0	
NORMAL (%)	Whole milk	60.0	54.3	45.0	35.0	±3.30
	Soymilk	57.0	63.0	40.0	31.0	
HEAD DEFECT (%)	Whole milk	15.0	16.0	20.0	23.0	±2.79
	Soymilk	16.0	17.0	21.0	24.0	
NECK DEFECT (%)	Whole milk	5.00	4.00	5.00	7.00	±1.23
	Soymilk	6.00	4.00	7.00	8.00	
TAIL DEFECT (%)	Whole milk	20.0	25.0	30.0	35.0	±2.85
	Soymilk	21.0	27.0	32.0	37.0	

From the experiment, it was observed that the whole milk (ext 1) and soy-milk (ext 2) have close concentration count; this shows that soy-milk can be replace in terms of whole milk as extender. The motile count of the whole milk 30×10^6 /ml and soy-milk 25×10^6 /ml up to day 4. From the above figure soy-milk can replace whole milk. Soy-milk (ext 2) exhibited the highest ability to sustain the viability of sperm motility followed by whole milk (ext 1). This could be attributed to the ability of these extenders to supply the nutrients needed for the metabolic maintenance of the sperm cells, control the pH of the sperm cells to the pH of freshly ejaculated semen, afford protection from cold shock and inhibit microbial growth.

The usefulness of sodium citrate as a good semen extender was discussed by Okukpe (1999) and Adeyemo *et al.* (2007) who reported that sodium citrate performed excellently well in maintaining the viability of stored fresh semen. It was observed from Table 2 that the highest sperm motility was obtained during the first 72 hours of storage throughout the trial period. This result is in line with the observation of Peterson *et al.* (2007) that the percentage of motile spermatozoa in buck semen stored in liquid form for 72h, progressively declined overtime

irrespective of whether storage occurred at 4 or 18°C.

The drastic decline in sperm motility of stored liquid semen could be attributed to gradual depletion of nutrients such as potassium, sodium and plasma protein required for high metabolic demands of sperm transport through the female genital tract.

As shown in Table 3, comparison between whole milk and soy-milk, showed that the level of cholesterol was higher in whole milk which could be detrimental to semen quality as observation of the semen under microscope was difficult compared to soy-milk which was easily observed under the microscope. According to the report of FDA (2011) and Michele (2011) soy protein significantly lowers cholesterol levels of people with moderately high to high cholesterol. Whole milk is most commonly used semen extender; however, its use involves high cholesterol, interference with fertility and poor microscopic examinations. Therefore, replacement of whole milks with a plant-based component with protective effects on spermatozoa would be advantageous. In present study, effect of soya milk-based extenders was observed on dilution and liquid preservation of buck semen at 5°C up to 4days in comparison with conventional whole milk extender. Soy milk is great for the dietary treatment of diabetes because soybeans have a low glycemic index and are cholesterol free.

Table 3: Composition of Whole Milk Versus Soy-milk as Extenders.

% NUTRITIONAL per 100g	WHOLE MILK	SOY-MILK
Protein N×6.25	24.5-27.0%	40.0%
Lipid	26.0-40.0%	20.0%
Carbohydrate	36.0-38.5%	35.0%
Ash	5.5-6.5%	4.9%
Moisture	2.0-4.5%	-

Source: Dairy Export Council, 2011

Soy-milk can be use as whole milk substitute because of its usefulness and easy availability to the farmers for extender product of semen extension for artificial insemination (Okukpe, 1999). The end result is a product that is superior to skim milk extenders when semen is

Conclusion

Results obtained from the present study indicated that soy-milk can be use as an extender in replacement of whole milk extender for storage of West African Dwarf buck semen up to 4days. Soy-milk replacer has 26% protein and 39% carbohydrates. It could compare favourably with dairy milk in nutritional property. It could provide higher benefits than dairy milk, because it is lactose free and cholesterol free. Soy-milk shows bright future due to recent promotion of its production, processing, utilization and marketing. Soy-milk can be use as whole milk substitute because of its usefulness and easy availability to the farmers for extender product of semen for artificial insemination. It is cheaper and majority of low-income households in rural areas of Nigeria could afford it. Soy-milk provides 81percent calories while whole milk provides 150percent calories. Whole milk has 33mg cholesterol while soy-milk is cholesterol free. Thus, due to the less saturated fat, the cholesterol free, and the protein level, soy-milk is a better option for extender.

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