EFFECTS OF DRYING METHODS ON DEHYDRATION, REHYDRATION AND PROXIMATE COMPOSITION OF BEEF, MUTTON AND CHEVON

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ABSTRACT
The study was aimed at investigating the effect of drying methods on dehydration, rehydration and proximate composition of meat. The experiment was laid down in a Complete Randomized design (CRD) involving two drying methods (Oven drying and sun drying) of types of meat serving as treatments (T1 and T2,), respectively. The treatments were replicated four times to give a total of twenty four (24) observations. Dehydration by Oven drying and Sun drying was done followed by rehydration of the samples at intervals. Results of dehydration indicated that SDM had 71% dehydration from its initial fresh weight. SDB had 78% moisture loss, SDC has 77% moisture loss. Similarly, ODM lost up to 78.8% of its moisture, ODB had 72.7% dehydration and ODC had 73.8% moisture loss. The highest moisture loss was found in SDB and ODM (78.9 and 78.8%) respectively, while the lowest dehydration was found in SDM (71.3%). Rehydration Results indicated that highest rehydration was found in ODM (61.73%) and the lowest was found in SDC (51.57%). Results for proximate composition of dehydrated and rehydrated samples indicated that drying methods have significantly affected ($p<0.05$) all proximate parameters measured. The study concluded that highest moisture loss was found in sun dried beef and oven dried mutton. The highest rehydration was found in oven dried mutton.
Keywords: drying methods, dehydration, rehydration

INTRODUCTION

Meat is a highly perishable product and soon becomes unfit to eat and possibly dangerous to health through microbial growth, chemical changes and breakdown by endogenous enzymes. The chemical composition of meat is also a significant factor in meat quality evaluation. The meat composition varies with the breed, species, age and the degree of fattening of the animal (Jalarama *et al,* 2012). The principle of meat preservation is concerned mainly with preventing or delaying microbial spoilage, autolysis, avoidance of weight loss and any changes in taste or texture (Macrae *et al*., 1997). Preservation methods include use of low or high temperatures, reduction of water contents (water activity) or adoption of chemical preservations. Among the many preservation methods, dehydration or drying is probably one of the earliest and most effective method developed (Ayanwale *et al*., 2007; Lim *et al.,* 2013). Sun drying meat under natural temperatures, humidity and circulation of the air, including direct influence of sun rays, is the oldest method of meat preservation (Baygar *et al.,* 2004; Taormina and Sofos, 2014). Continuous evaporation and weight losses during drying cause changes in the shape of the meat through shrinkage of the muscles and connective tissues.

Rehydration is a complex process aimed at the restoration of raw material properties when dried material is in contact with water (Ribah *et al.,* 2013). Different drying techniques have significant role in the development of porosity in the meat samples. The higher the porosity in meat structure, the higher will be the rehydration in the dried meat product (Rahman *et al.,* 2005). Rehydration depends on the water absorption capacity, water holding capacity of muscle fibers and the formation of spaces within muscle fibres, affecting dehydration, rehydration and textural quality of meat (Jayaraman *et al*., 1990; Garcia-Pascual *et al*. 2005; An *et al*. 2013). The rehydration characteristics of dried food materials are used as a quality parameter and show whether physical and chemical changes occurred during the drying process due to process conditions, pretreatments and sample composition (Lewicki, 1998). The main aim of this study was to determine the effect of sun drying and oven drying methods on dehydration and rehydration of beef, mutton and chevon.

MATERIALS AND METHODS

The experiment was carried out at Animal Science Laboratory, Kebbi State University of Science and Technology, Aliero, Kebbi State

Treatments and Experimental Design

The experiment was laid down in a Complete Randomized design (CRD) involving two drying methods (Oven drying and sun drying) of types of meat serving as treatments (T1 and T2,) respectively. The treatments were replicated four times to give a total of twenty four (24) observations.

Preparation of Meat Samples for Drying

Five hundred grammes (500g) each of beef, mutton, and chevon were purchased from Aliero slaughter slab in the morning. Each of the meats was trimmed of external fats, connective tissues and other physical dirts, washed and cut into eight (8) equal pieces weighing approximately 60g each. Four pieces of each meat sample was subjected to oven drying while another four pieces of each meat was subjected to air/ sun drying. Both the sun drying and oven drying were terminated when three consecutive constant weights of samples have been achieved.

Determination of Dehydration by Sun Drying of Meat Samples

The meat samples prepared for sun drying were first dipped into a 14% w/w salt solution to prevent microbial growth and then spread on drying wire mesh and kept where there was solar radiation and free flow of air from 8am to 5pm every day until the samples attains three consecutive equal weights. Rate of dehydration was calculated by a formula:

Determination of Dehydration by Oven Drying of Meat Samples

The meat samples prepared for oven drying was set in an oven and set at temperature of 70^{o} c. The meat samples were weighed every 20 minutes until the samples measure 3 constant weights. Rate of dehydration was calculated by a formula;

Determination of Rehydration of Dried Meat Samples

All the dried meat samples were individually soaked in a container of clean water and their weights taken at intervals of two hours each for a period of eight hours. Rate of rehydration was measured by a formula;

Determination of Proximate Composition of Dried Beef, Mutton and Chevon

All proximate components were determined using standard methods of the AOAC (2000).

Data Analysis

Both data on dehydration, rehydration and proximate composition was analyzed using T-test to compare the drying methods for different meats.

RESULTS AND DISCUSSION

Effect of Drying Methods on Dehydration of Mutton, Beef and Chevon

Table 1 shows the result for effects of drying methods on dehydration of beef, mutton and chevon. Results indicated that drying methods had highly significantly affected ($p<0.05$) dehydration across all the meat

Table 1: Effect of drying methods on dehydration of mutton, beef and chevon

Samples	Fresh weight (g)	Dried weight (g)	Dehydration (g)	Dehydration (%)	p-value
Sun Dried Mutton (SDM)	61.35	17.6	43.75	71.3	8.42E-08**
Oven Dried Mutton (ODM)	61.3	13.0	48.35	78.8	
Sun Dried Beef (SDB)	55.0	11.6	43.4	78.9	1.80E-07**
Oven Dried Beef (ODB)	55.0	14.9	40.01	72.7	
Sun Dried Chevon (SDC)	68.7	15.3	53.4	77.7	1.14E-06**
Oven Dried Chevon (ODC)	68.7	18.0	50.7	73.8	

** highly significant ($p<0.05$)

types. For muton meat, Oven Dried had higher (78.8%) dehydration than sun dried mutton (71.3%) with p-value of 8.42133E-08. However, for beef and chevon, sun drying had had shown more dehydration than oven drying. While sun dried beef had 78.9%, sun dried beef had 72.7% dehydration with a p-value of 1.8026E-07**. Similarly, sun dried chevon had 77.7 while oven dried chevon had 73.8% with a p-value of 1.14932E-06**.

Effect of Drying Methods on Rehydration of Mutton, Beef and Chevon

Table 2 presents the results for effect of drying methods on rehydration of beef, mutton and chevon. Results indicated that after 10 hours rehydration, drying methods had highly significantly affected ($p<0.05$) rehydration on beef and chevon, but mutton was not significantly affected ($p>0.05$). As far as rehydration is concerned, oven dried beef and chevon had shown higher moisture absorption than mutton. Oven dried beef was significantly higher (61.3%) than sun dried beef (60.2%). Similarly, oven dried chevon had absorbed more moisture (55.4%) than sun dried chevon (51.55%) with a p-value of 7.15195E-06**.

Table 2 Effect of drying methods on rehydration of mutton, beef and chevon.

SAMPLES	Rehydration Time (Hours)						TR	%	p-value
	0	2	4	6	8	10			
Sun Dried Mutton (SDM)	13.2	18.6	20.1	21.6	21.8	22.4	9.2	58.9	0.38
Oven Dried Mutton (ODM)	10.0	15.6	16.4	16.8	16.9	16.2	6.2	61.7	
Sun Dried Beef (SDB)	8.7	12.8	13.8	14.4	14.4	14.4	5.7	60.2	0.0002**
Oven Dried Beef (ODB)	10.3	16.7	17.4	17.9	17.7	16.8	6.5	61.3	
Sun Dried Chevon (SDC)	11.5	17.4	19.8	21.1	21.7	22.3	10.8	51.5	7.15E-
Oven Dried Chevon (ODC)	12.2	23.7	24.4	24.7	24.1	22.0	9.8	55.4	06**

** highly significant ($p<0.05$) TR= total rehydration

Generally, from the foregoing results, it was observed that oven dried samples has more water absorption compared to the sun dried samples. The percent rehydration of mutton beef and chevon were 61.7%, 61.3% and 55.4%, respectively. The reason why oven dried samples absorbed more moisture is not unconnected with the degree of dehydration of the samples. When the product attains the highest degree of dryness, there will be more pores occupied by air which upon soaking can absorb more moisture than products that did not dry. Rehydration is one way to analyze dried products. A high value of rehydration ratio means the dried product has a good quality because the pores allow water to reenter the cells (Noomhorm, 2007).

CONCLUSION

The aim of this study was to determine the effect of sun drying and oven drying methods on dehydration and rehydration of beef, mutton and chevon. After drying and a 10 hours rehydration at room temperature, the study concluded that highest moisture loss was found in sun dried beef and oven dried mutton. The highest rehydration was found in oven dried mutton.

REFERENCES

AOAC. (2000). Association of Official Analytical Chemists. Official Methods of Analysis, 17th Edn., Washington, D.C

An, K., Ding, S., Tao, H., Zhao, D., Wang, X. and Wang, Z. (2013). Response surface optimisation of osmotic dehydration of Chinese ginger (*Zingiber officinale* Roscoe) slices. *Int. J. Food Sci. Technol.* 48:28–34

Ayanwale, B. and Ocheme, O. (2007). The effect of sun-drying and oven-drying on the nutritive value of meat pieces in hot humid environment. *Pakistan J Nutri*. (2007) 6:370–4.

Garcia-Pascual, P., Sanjuan, N., Bon, J., Carreres, J.E. and Mulet, A. (2005). Rehydration process of *Boletus edulis* mushroom: characteristics and modelling. *J. Sci. Food Agric.* 2005;85:1397–1404

Jalarama, R.K., Pandey, M.C., Harilal, P.T. and Radhakrishna K. (2013). Optimization and quality evaluation of freeze dried mutton manchurian. *Int Food Res J.* 20:3101–6.

Jayaraman, K.S, Das Gupta, D.K. and Babu Rao, N. (1990). Effect of pre-treatment with salt and sucrose on the quality and stability of dehydrated cauliflower. *Int. J. Food Sci. Technol*. 25:47–60.

Lewicki P.P. (1998). Some remarks on rehydration of dried foods. *J. Food Eng*. ;36:81–87

Lim D. G., Lee S.S, Seo K.S., Nam K.C. (2012). Effects of different drying methods on quality traits of Hanwoo beef jerky from low-valued cuts during storage. *Korean J Food Sci Anim Resour.* 32:531–9.

Macrae, R.. R.K. Robinson and M.J. Sadler, 1997. Encyclopedia of Food Science, Food Technology and nutrition: Academic press Inc, 1456: 2916-2934

Mishra B, Mishra J, Pati P, Rath P. (2017). Dehydrated meat products: A review. *Int J. Livestock Res.* 7:10–22.

Noomhorm A. (2007). Overview of dehydration method on quality of fruit and vegetables. SWU Sci. J. ;23:9–22

Oyinloye T.M., Yoon W.B. . (2020). Effect of freeze-drying on quality and grinding process of food produce: A review. Processes8:1–23. doi: 10.3390/ PR8030354

Rahman et al., 2005 influence of storage conditions on shelf-life of dried beef product (Kilishi). *World J Agric Sci.* (2009) 5:34–9.

Rahman MS, Labuza TP. Water activity and food preservation. In: Rahman MS editor. And book of Food Preservation. Boca Raton, F. L.: CRC Press (2007). p. 465–94

Ribah, M.I., M.Jibir, N.Muhammad, S.Garba, B.A.Shinkafi and M.A.Muftau 2014). Effects of osmotic dehydration on rehydration of banda- a Nigerian dehydrated meat product. Proceedings of 39th annual conference of the Nigerian society for animal production. Babcock University, Ileshan Remo, 16th-19th March, 2014. Pp495-497. ISBN1596-5570

Taormina P.J, Sofos J.N. (2014). Low water activity meat products. In: Gurtler J, Doyle M, Kornacki J editors. The microbiological safety of low water activity foods and spices. New York, NY: Springer. p. 127–64.