

WORLD OSTRICH ASSOCIATION
FACTORS INFLUENCING MEAT QUALITY



World Ostrich Association

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INTRODUCTION

The objective of this document is to provide basic information on the different factors that influence Meat Quality as guidelines for the Industry. We have defined very simply the different areas and factors that influence meat quality. Much of this information is basic knowledge. However, as Ostrich is a new industry there are many who are either involved with processing meat for the first time or have been forced into processing to find a market for their birds with little or no previous experience in meat production and processing.

As a new industry there is a lack of supporting data as it relates to Ostrich, but the principles are the same as for other comparable mainstream meat specie. Over time the WOA Meat Standards committee will update any relevant sections as the information becomes available and/or specific trials/tests have been carried out.

It maybe certain trials/tests will become research projects instigated by the WOA. It maybe, where information is of a generic nature but work has been carried out by a specific company they will publish their results as the information is of benefit to the industry as a whole. No company can be, or should be, expected to divulge information that is of a proprietary nature as they develop at their own expense new technology. They will share the results of that technology if it is marketable to others and would assist others in developing their businesses, as is normal practice in any industry. We ask members to report to this committee any information that becomes available that you feel may be relevant.

The Meat Standards Committee has listed 10 Major areas of the value chain that have a direct influence on Meat Quality:

Farm Management

1. Age of animal
2. Management Systems
3. Nutrition

Handling and Slaughter Technique

4. Handling prior to slaughter
5. Slaughter techniques
6. Cold Chain during slaughter

Storage, Distribution and Display

7. Storage and maintenance of the cold chain during distribution
8. Storage and Display Life
9. Method of display

Hygiene

10. Hygiene at all stages

Farm Management

1. Age of Birds

a. Influence of Age on Meat Quality

It is a well-established fact that the older an animal the tougher the meat. For this reason main stream livestock industries have established grades and/or names to account for the age of the animal. They have also established means for determining

World Ostrich Association Factors Influencing Meat Quality

the age of the animal. Depending on the specie it may be by teeth development, degree of bone ossification or similar. Provided the animal meets the basic health criteria all meat is fit for human consumption, with different ages having different uses, different markets and therefore different price structures.

b. How to Identify and Verify Age in Ostrich

Having no teeth, ostrich can be aged according to feather development and/or bone ossification. However, there is insufficient data available to verify that feather development and/or bone ossification may be used as an accurate method to determine bird age at this time. Since there are significant variations in bird rearing methods and nutrition this results in a wide variation of feather development and possibly bone ossification for birds of same age. Thus, these methods are unreliable at this time and need further studies.

To date there has only been one study carried out on age identification by bone ossification. There will need to be many more studies carried out to provide sufficient data to be able to determine the accuracy of this method for age evaluation in Ostrich.

Therefore at this time the only method to verify the true age of Ostrich is through verifiable farm recording systems.

2. Farm Management

It is well known that range grazed cattle or sheep produce a different quality meat than their feedlot raised counterparts. However, the main reason for the differences in meat quality, uniformity of carcass and taste is nutrition based as the diets fed vary significantly between the systems.

a. Farm Systems

Most range grazed cattle or sheep these days will be fed vitamin and mineral supplement feeds which vary from a few vitamins and/or minerals to protein, energy and vitamin and mineral supplements that are balanced to match the estimated intake of the grazed material. The more intensive the system, the greater the control of a balanced feed intake, therefore the greater degree of high meat quality predictability. The variations in carcasses and meat quality are taken care of by the carcass and meat grading systems and yield grading systems in place for the relevant specie. Similar variations are seen with Ostrich dependent on the management systems used.

b. Stress

It will affect meat quality by affecting meat characteristics. Also trauma or any accidents (farm design, fences, spaces, adverse bird handling and other stress related factors) may cause Oedema or "jelly" substance on heart, thigh or sternum which will affect carcass grade.

c. Vaccination program, antibiotics and hygiene

Any evidence of disease symptoms in a carcass will affect its grade. Observing proper withholding times after vaccination and antibiotic injections is important to avoid residue in meat after slaughtering.

Biosecurity and other techniques of preventive veterinary procedures are important to avoid diseases and parasites affecting meat quality. [1]

3. Nutrition

World Ostrich Association Factors Influencing Meat Quality

The influence of Nutrition on meat quality is well documented and never disputed with all specie. Advanced nutritionists will tell you that the basics of livestock nutrition are the same for all specie - the skill comes in identifying the unique requirements and tolerances as they apply to each specie. Increasingly discerning consumers, the influence of the globalisation of agriculture, the increasing influence of supermarkets and marketing chains looking for absolute consistency have seen significant developments, over the last thirty years, in nutritional technology being used as a mechanism to improve meat quality. Taste, Tenderness, Aroma, Colour and Uniformity are all affected by nutritional factors. This improved technology is also known to decrease drip loss and to extend shelf life through control of colour on oxidation, resulting in improved overall customer acceptance, to give significant commercial benefits.

Slow growing muscles will be less tender than an animal that grows muscles more quickly. It is important to differentiate between nutrition that "forces" certain factors that may be considered "against nature" as opposed to "quality nutrition" that enables the specie to develop naturally to the full genetic potential. The economic benefits to producers for achieving greater meat yields and earlier slaughter ages are also well documented in all specie as being controlled by nutrition.

In all other production livestock specie an animal carrying white fat is recognised as being healthier and that it produces a better tasting meat. Fat production and quality is totally controlled by diet. The reason often given for this not being considered an issue with Ostrich has been the thought process that as there is little or no marbling in the meat therefore yellow fat will not influence meat taste. This in fact is not true since fat quality is an indicator of imbalanced rations that are deficient in certain nutrients at the correct levels or are not in balance to each other. Imbalanced rations affects the formation and degradation of minerals and vitamins in liver and kidney causing yellow fat, possible tainting of the meat and will also result in less acceptable quality offal.

Other factors that "taint" the meat are the use of certain ingredients in rations. For example the use of fish meal in rations for slaughter animals can leave a "fishy" taste and it is well known that Ostrich are sensitive to iron, so use of ingredients with high iron content can taint the meat to give a livery taste.

Stress is always a factor in meat quality. Stress can come in many forms and nutritional stress can be a factor all on its own. A bird can suffer undue stress if fed an improper diet. As poor feeding or imbalanced diets affect the immune system, the bird will be much less tolerant to diseases and other types of stress, which also can have a major affect on meat quality.

Handling and Slaughter

4. Handling Prior to Slaughter

Minimising stress at all stages of production is continually emphasised and extremely important as it is associated with DFD (Dry Firm Dark) meat and long term stressed animals result in high pH levels in the meat. However care needs to be taken to ensure that the method an animal has been raised has been taken into consideration as diet also impacts on both the consistency of the meat as well as the ability of an animal to handle stress.

World Ostrich Association Factors Influencing Meat Quality

Ostrich are generally brought to the slaughter plant the day prior to slaughter. Every effort needs to be made to ensure as stress free transport as possible. It is important that they have water available and protection from the elements. It has been suggested that birds should stand for a few days to recover. However this suggestion needs to be thought through very carefully:

It is well known that Ostrich do not like change of environment and can take some time to settle and start eating well so holding the birds for a few days will not reduce that stress factor and may in fact aggravate the effects of long term stress. In addition the commercial implications are significant. Holding pens for anything more than overnight would have to be very much larger than is the norm at slaughter plants as birds held for a few days would require 3 or 4 times the area, plus there are cost implications for looking after birds. As birds take time to settle and start eating there will inevitably be some additional weight loss thereby causing loss of revenue, whilst probably aggravating the stress factor. Some independent studies have confirmed that slaughter aged birds do not begin to regain lost body weight back for 3-4 weeks after a move of significant distance and being held in a strange environment.

Slaughter plants in South Africa have reported very significant improvements in pH levels, to below the critical 5.8 level as a result of changes in handling in the lairage and immediately prior to stunning. This is achieved by employing staff that are very quiet and calm with the birds. This is particularly relevant since most published reports currently available referencing Ostrich suggest that Ostrich carry higher than acceptable pH levels, when these slaughter plants have now proved this information to be incorrect and misleading.

5. Slaughter Techniques

Only one official study has been carried out on different methods of stunning Ostrich. As this did not cover all systems in use it is of little value without further follow up studies. The main focus of this particular study was recording the degree of unconsciousness at bleed out rather than impact on meat quality.

Factors that influence meat quality during the slaughter process are:

- ❖ Method of Stunning and/or Kill
- ❖ Handling of Birds post stunning/kill
- ❖ Whether bird is Killed prior to Bleeding or stunned prior to bleeding
- ❖ Speed and degree of Bleed Out
- ❖ Muscle Stimulation post stunning (now believed to have a negative impact on quality)

To date there have been no published studies carried out on the impact of different techniques on meat quality and therefore it will be the responsibility of each slaughter plant to investigate thoroughly the options available, remembering at all times that minimising stress must be a consideration.

Note: Electrical stunning is accepted for OSTRICH slaughtered Halaal under Islamic rules and CAN be stunned prior to bleeding. [2]

6. Cold Chain During Slaughter and Processing

The influence on meat quality of maintaining the cold chain during slaughter and processing is bacterial. The faster the carcass is chilled, the greater the ability to

World Ostrich Association Factors Influencing Meat Quality

control bacterial growth and therefore extend the shelf life from a bacterial viewpoint. Some slaughter plants have all activities on the same floor - EU and some other country regulations specify that slaughter, defeathering, deskinning and evisceration are all carried out in separate sections to minimise risks of cross contamination. When these operations are separate, the cooling down process usually commences with the deskinning. This also has the advantage that the carcasses have cooled considerably by the time they enter the Chiller.

It is the general aim to chill the muscles to below 4degrees centigrade prior to deboning, with processing carried out with sufficient speed that the muscle temperatures do not rise above 4 degrees centigrade before returning to the Chiller or being blast frozen.

Insufficient work has as yet been carried out on the impact of hanging time on meat quality. In order to achieve accurate data on this, the rearing method would also need to be known.

With Ostrich, there has been a certain amount of "on farm "processing. [3] It is extremely important that those producers processing birds on farm do so with the correct facilities in place if selling to the general public and do not simply process in their kitchen. Without the necessary controls for temperature and hygiene, the risks are too great.

Storage, Distribution And Display

7. Storage and Maintenance of the Cold chain

This area is one of the toughest areas to control in view of the fact that the distribution chain requires dependency on freight haulers and is out of the direct control of the processor. Airlines will provide no guarantees. Certain truckers will turn off their refrigeration to "save" on fuel. The meat may take time to put into the display cabinet and so on. It is well documented that bacteria growth increases rapidly once the temperature of the meat rises above 4 degrees centigrade. In Europe if the meat temperature exceeds 4 degrees centigrade it is no longer allowed to be sold.

8. Storage and Display Life

There are many methods of storing and packaging and these will influence the quality. Individual companies will need to investigate the best methods available to them for the particular market that they are serving and what is available to them in their own region.

It is important to know that Ostrich meat has had a particularly poor reputation for darkening and/or developing black spots on oxidation. While there are certain aspects in processing that can assist in preventing this, it needs to be understood that the nutrition qualities of the diet fed to any animal has a direct impact on the quality, colour and display life of the meat. If adequate nutrients are provided in the diet, this can have a significant and positive impact on the meat quality, colour and display life which has been proven to be as effective in Ostrich meat production as with other red meat specie.

9. Method of Display

Meat can be displayed either frozen, fresh packaged or fresh in display cabinets with no packaging. Frozen clearly provides the greatest shelf life so long as the display

World Ostrich Association Factors Influencing Meat Quality

freezers are maintained at the correct temperatures. The method of packaging can influence the shelf time of display when packaged. The method of packaging can also have a significant impact on display shelf life with the displays without packaging probably having the shortest shelf life. The meat should have a similar shelf life to other meats if:

- ❖ Temperatures are maintained correctly to minimise bacterial growth
- ❖ Slaughter techniques have been correct to minimise stress
- ❖ The pH levels are correct
- ❖ Bacteria contamination has been kept to a minimum
- ❖ The cold chain has been maintained

Worthy of note is the influence of meat colour on consumer acceptability. It has been stated that by preventing loss of colour and by increasing shelf life by 1-2 days would save the US industry \$175 million to \$1 billion (US) annually. As a result of the commercial benefits to the retailer, US Beef producers are paid a premium when producing beef using technology to achieve this. This same technology is effective with Ostrich production and overcomes the current consumer resistance to the dark colour of much of the Ostrich meat currently produced.

Hygiene

10. Hygiene at all stages

Bacterial growth could probably be considered the No. 1 enemy to extended meat life and maintaining quality. HCCP - Hazard Critical Control Points - systems are compulsory now in many regions - but whether or not they are compulsory, a good HCCP system should be implemented as part of a quality control program. All points of possible bacterial contamination need to be identified at all stages of the slaughter and processing procedure. Controlling the pH levels of the meat, as well as correct maintenance throughout the cold chain, is instrumental in controlling bacterial growth. It is worth noting that meat must be free of pathogenic organisms (salmonella for example) and their toxins.

References

[1] Vaccination of birds is not yet approved by some countries. It is important that you check with your own veterinarian as to what is permitted in your country.

[2] For further information please contact:

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[3] On Farm Slaughter Only permitted in certain countries.