Chapter 1: INTRODUCTION

The per capita consumption of beef in Australia has been declining since the mid 1970's. This trend is similar for many mature market countries such as the United States Of America, Britain and many of the European countries such as Poland and Hungary.

Many meat scientists and retail and food service companies have developed theories for this decline. The scientific research has mainly focused on the tenderness issues, as tenderness has been identified as the major palatability trait leading to consumer satisfaction (Morgan et al., 1991; Morgan et al., 1992; Savell and Shackelford, 1992; Anon., 1994f; Dransfield, 1994; Koohmaraie, 1994). The areas identified as affecting tenderness have included the genetics of the animal, animal age, feeding regime pre-slaughter, electrical stimulation, ageing of carcasses and primal cuts, mechanical and chemical tenderisation and the cooking procedure and internal temperature (Anon. 1994f). The components of tenderness have been identified as either the myofibrillar or connective tissue components of muscle (Shorthose, 1993). With the collagen component of connective tissue being called the background toughness of meat.

Important assessments of the amount of variation in tenderness accounted for by certain muscle components in young beef have been identified as myofibrillar fragmentation 50 percent, marbling 10 percent, water content 10 percent, pH 10 percent, cold shortening 10 percent, external fat thickness 3 percent, collagen 1 percent and other 5 percent (Anon. 1994f).

The Australian Meat Research Corporation has funded research projects aimed at developing objective palatability assessment equipment, such as the "tendertec" probe and video image analysis equipment, in the belief that if beef products are consistent in tenderness and the tougher product is rejected from retail and food service sales then the

consumer will receive a more reliable eating product and sales for beef will improve. United States meat scientist have also pursued objective assessment of tenderness and Koohmaraie (1995) believes the use of the Warner Bratzler shear force equipment is close to being adopted in commercial use to identify tough carcasses.

However, other researchers have identified many other reasons for the decline in beef sales. These include concerns of healthiness and diet (Cross and Saville, 1993; Teys, 1993 and Richardson et al., 1994), lifestyle and the increase in affluence (Harrington, 1994) and the competitive pricing of alternative meat sources (Gorny and Akmadi-Esfakani, 1993).

While all of the above may be true, marketing departments of individual food service and retail meat companies have tended to focus on new product lines and more competitive marketing strategies, rather than solve the problems of the individual product line and thus solve problems for all of the meat industry. Qantas Flight Catering Limited of Australia saw the use of beef meals reduced from approximately 75 percent of international and domestic airline meals in the early 1980's to approximately 35 percent in 1992. The main reasons for this decline have been the high levels of customer complaints in relation to tough inconsistent product, poor menu choices, consumers perception that beef is a "heavy" meal when travelling and the opportunity for customers to request special dietary meals lead to the use of more vegetarian alternatives (Predeth pers. com. 1992).

A number of food service companies have identified that the consumers perception that beef is not as healthy as white meats. In addition, inconsistency of beef products, small menu alternatives for new product lines and consumers individual preference for a particular degree of doneness when eating beef were identified. White meats have a distinct marketing advantage as the product is more consistent, there is less consumer satisfaction requirements to meet and a wider range of alternative menu items to choose.

Food service and retail meat companies need to develop a management process that accurately identifies the satisfaction requirements of their customers over the short, medium and long term periods, develop continuous improvement initiatives and ongoing recording mechanisms, focus on the simultaneous improvement in cost, quality and delivery, utilise

appropriate existing and advanced technology, communicate these processes with employees, suppliers and customers, have strong leadership from the top management and create a culture within the organisation that empowers all to strive for world class performance.

These initiates can be likened to the production system changes that have occurred within the automobile industry, where the reductionist management theories such as Taylorism, worked at breaking down jobs into discrete and simple repetitive tasks. This enabled the employment of less skilled employees and the use of more automated equipment, but this has now been replaced by a customer focused "lean" system, which identified exactly what the customer required and delivered to those specifications. The "lean" production system is the main management system adopted by the leading automobile manufacturers today (Womack et. al. 1990). The best practice management system has been modelled on this "lean" production system.

Because of the diverse range of food service and retail meat companies operating under various demographic conditions, these companies need a set of procedures that are flexible and can be implemented under a wide range of circumstances.

This study reviews the best practice management system and the main meat palatability traits associated with meeting consumers satisfaction requirements as we know them today. A flexible set of best practice management procedures will be developed for food service companies wishing to develop a customer focus. The development of a customer focused set of procedures will enable companies to continually respond to their customers and develop a competitive advantage over competitors. The accurate identification of consumer issues will better focus the marketing and research and development departments of food service companies so that more efficient use of resources are made and a higher success rate of research and marketing initiates will be developed with higher financial gains.

The study focuses on real commercial case studies within a number of food service companies and enterprises. These individual case studies are presented as a compilation of papers that each represent an individual chapter.

Each individual chapter was part of a systematic approach to improve consumer satisfaction within the food service industry. Chapter 3 outlines the best practice procedures developed to benchmark the beef and lamb products being sourced by the airline catering industry. Chapter 4 describes this benchmark study. This industry was initially chosen because of the high level of consumer complaints and the inability to rectify the problem to a satisfactory level. The procedures described in chapter 3 were further used in chapters 5 and 7. The benchmark study of chapter 4 identified that there was major variation in degree of doneness of beef steaks of different pH levels. Chapter 5 investigates some of the causes of this variation and the importance of pH as a major contributor to degree of doneness variation. Chapter 6 is an audit of the major Australian Aus-meat categories and processing companies supplying beef products to the airline, restaurant and steakhouse sectors of the food service industry in N.S.W. Because of the high level of pH variation identified in chapter 6 it was necessary to investigate in chapter 7 the impact this variation had on delivered degree of doneness as perceived by the consumer and how their acceptance of the degree of doneness affected their sensory assessments.

Chapter 2: LITERATURE REVIEW OF BEST PRACTICE PROCEDURES AND MANAGEMENT PRACTICES

2.1 INTRODUCTION

The "lean" production system developed by the Japanese car manufacturer Toyota in the late 1940's has been credited with the introduction of the principles of best practice as we know them today (Womack, Jones and Roos, 1990). However, the Japanese Zen priest of the sixteenth century, Shosan Sukuki has been credited with the development of capitalism in Japan. Sukuki taught a Zen-based social ethic in which people had to become "living Buddas" in order to live the way he felt they should. Sukuki wrote "Travel around the country to distant parts to bring people what they desire". Suzuki's philosophy to any business man who pursues his trade to make a profit will fail. It is only by keeping the needs of consumers and the nation in the forefront of all thinking, planning and working that one can succeed. These beliefs are fundamental to the cultural way of "Wa". The principles of "Wa" is now given credit for almost every aspect of Japanese management that has proved effective. Womack, et al.,(1990) attributed the "lean" production system as having the best attributes of both the "craft" and "mass" production systems. By combining the use of highly skilled workers that made exactly what the customer required with efficiencies and cost savings of production line systems.

"Lean" production employs multiskilled workers at all levels of the organisation and uses highly flexible, increasingly automated machines to produce a wide variety of products and product lines. The term "lean" is used because this system uses less of everything than the "mass" system.

The customer focus employed by the "lean" system built a life long relationship between Toyota and its customers. Cars were manufactured two to three weeks after sales staff had interviewed their customers and identified exactly the requirements needed. Sales staff then kept data on their customers change in income, family size, driving patterns and tastes. This data not only helped sales staff know when the customer was likely to want to purchase their next car but it also gave Toyota valuable data that could be used in product development.

The "lean" production system is very versatile and can be applied equally to every industry across the globe (Womack, et al., 1990). This is further supported by Anon. (1994a) where a study of Australian and New Zealand companies using best practice procedures, showed that the practices and outcomes within each industry sector was greater than the variation across sectors.

The traditional western management theories called Taylorism and Scientific Theory of Management, where work was broken down into discrete and simple repetitive tasks, that were performed by less and less skilled employees and increasing automation was the foundation of western production systems up to the 1970's and 1980's. The best practice processes weren't adopted by western management till these later years. Table 2.1 describes the changing management philosophies that have occurred since 1930.

Traditional organisational structures, customer service philosophies and business methods are no longer competitive. (Carr, et al. 1995). In the late 1980's and early 1990's cost cutting methods (downsizing - cost reduction by removing people) lead to customers suffering and low employee morale (Anon. 1994b).

Today's management requires organisations to be customer and market driven, process focused and team orientated.

Hammer and Champy (1994) believe today's business revolution is caused by customers demanding product and services designed for their particular needs, competition, where similar goods sell on the basis in one market on price, another on selection, somewhere else on quality and elsewhere on service before, during and after the sale and the constant change occurring, where now change is part of normality and the pace of change has accelerated.

Competitive focus is shifting to innovation because customers expect more choice, intellectual inputs are more important than traditional physical inputs, wealth creation is more about capturing new ideas and applying them commercially and product life cycles are getting shorter (Anon. 1994b).

Table 2.1: Changing Management Philosophies Since 1930 (Carr, et al., 1995).

Reengineering - Michael Hammer	1988
Federal Executive Order	1986
Total Quality Management Movement Quality Circles	1980
Zero Defects - Phillip Crosby	1970
Japanese Quality Movement - Ishikawa, Taguchi	1960
Statistical Process Control - W. Edwards Deming - A.V. Feigenbaum - J.M. Juran Reconstruction of Japan	1950
Application of Statistical Sampling Technique for Bureau of Census - W. Edwards Deming	1940
Statistical Sampling - Walter A Shewhart	1930
Time and Motion Studies - Frederick Taylor	1920

2.2 BEST PRACTICE DEFINITION

"Best practice is the co-operative way in which firms and their employees undertake business activities in all key processes: leadership, planning, customers, suppliers, community relations, production and supply of goods and services and the use of benchmarking. These practices when effectively linked together, can be expected to lead to sustainable world-class outcomes in quality, customer service, flexibility, timeliness, innovation, cost and competitiveness." (Anon. 1994a).

Carr, et al.,(1995) surveyed 47 U.S. and European businesses and believes this definition does not place enough emphasis on the financial bottom line and suggests that best practice is more effective when it is combined with reengineering processes. The leading businesses surveyed had used reengineering processes that enabled quicker and larger improvements in the initial stages of adoption.

Best practice is ultimately demonstrated through an organisation's recognition in the market place by peers and customers, developed and sustained over a period of time. It is profitable, growing, innovative and sustainable. (Casey, 1995).

2.3 BEST PRACTICE MANAGEMENT PROCESSES

A process is a set of linked activities that take an input, transform it and create an output (Carr, et al.,1995). This process should add value and create a product that is more useful for the customer

There are four categories of processes identified by Carr et al., (1995). These are:

* Identity processes - define the organisation to itself, customers and investors;

* Priority processes - affect everyday performance;

* Background processes - necessary for the business to survive; and

* Mandated processes - carried out due to Government or regulations.

Best practice requires the achievement of world class standards of improvement through a comprehensive and integrated approach to organisational change and the process to be continuous. A number of core components and processes for successful achievement of these standards have been identified by Dertouzos et al.,(1989 :

* Strong leadership from the top management in developing a vision and implementing a long term strategy for world class performance;

* Extensive consultation and communication with employees to develop a shared understanding and commitment to the corporate goals;

* A focus on simultaneous improvement in cost, quality and delivery;

* Better utilisation of existing technology and the adoption of the most appropriate advanced technology;

* Implementation of training and education programs to enhance and broaden the skills of management and employees;

* Commitment from employees through increasing the breadth of their decision making and involvement in other traditional management responsibilities;

* Closer links with customers and suppliers;

* A culture in which everybody in the organisation is encouraged to make ongoing improvements to the way work is done;

* Integrated approaches to the management of an organisation that establish effective links between functions such as sales and production.

Casey, (1995) further lists:

* A commitment to continuous improvement;

* The pursuit of innovation;

* The use of performance measurement systems and benchmarking;

* The integration of environmental management and

* Involvement in external relationships (networks).

Dramatic change is effected if the efforts are targeted at processes that directly affect the customer, not at processes that are completely internal to the company (Carr, et al., 1995).

A focus on customer satisfaction is the key performance indicator leading to successful outcomes from the implementation of best practice (Hammer, et al., 1994; Anon.1994a; Anon. 1994b; Anon. 1994c; Carr, et al., 1995).

Survey results from companies identified as "leaders " or "laggers" in Australia, identified that 80% of "leaders" were aware of their external customers future requirements compared to 42% of "laggers" Anon. (1994a).

The Australian Customer Service Association, unpublished data (1995) quote that:

* Only 4% of dissatisfied customers complain.

* 91% of dissatisfied customers will never come back.

* One dissatisfied customer tells more than eight people about the problem.

* One in five tells twenty people.

* It takes 12 good service incidents to make up for one bad one.

* Seven out of ten complaining customers will come back again if you resolve the complaint in their favour.

* 95% will return if the complaint is resolved on the spot.

* Bad service costs a business 2% market share a year.

* Good service brings a 6% increase in market share a year and allows higher prices to be charged.

Leading-edge customers are regarded as the key link as they constantly drive you to improve your performance, they constantly open doors to other customers, they work with you as development partners and they generate ideas that lead to innovation (Anon. 1994b).

Other key performance indicators identified by Casey, D., (1995) were, employee satisfaction, cost, quality, timeliness, waste, defects, productivity, output and financial performance.

The Australian Quality Council (Anon., 1994h) have identified seven key areas of organisational performance:

* Leadership
* Customer Focus
* Policy and Planning
* Information and analysis
* People
* Quality of process, product and service
* Organisational performance through measurable data from key indicators

Leadership and customer focus are seen as both drivers of the management system, policy and planning, information and analysis and people are seen as key components of the system. Quality of process, product and service also focuses on how businesses and operational results are achieved. Organisational performance is the outcome (Casey, 1995).

a. Leadership

Best practice must start with and maintain executive support. Corporate executives cannot be change leaders until they have committed to change themselves (Carr et al., 1995). Carr et al., (1995) describes the characteristics of leaders and managers in table 2.2.

Table 2.2: Characteristics of Leaders and Managers.

Leaders	Managers
Establish and communicate the vision	Carry out the vision
Motivate Employees	Motivate, guide and direct employees
Establish and exhibit fundamental values	Translate fundamental values into business results
Focus on the future	Understand future direction but monitor the present

The primary function of leadership is to produce change, while managers produce orderly results and plan, leaders set direction and develop vision and strategy, managers organise and staff activities, while leaders align people by communicating the vision and empower action (Carr et al., 1995).

Leaders create an environment for quality, promote improvement and facilitate change (Anon. 1994c).

Leaders must understand the organisations readiness for change and communicate the compelling need for change , as well as the vision he or she has set out for the organisation's future. Most organisations undertaking the introduction of best practice are doing so because they have recognised an extremely compelling need for change (Hammer et al., 1994; Anon. 1994a and Carr et al., 1995).

In a study of small and medium sized companies identified as "leaders" or "laggers" within Australia (Anon. 1994a), aspects identified for leadership of "leaders" over " laggers" were, senior management actively encouraged changed and implemented

a culture of trust, involvement and commitment, they identified "Champions of Change" to effectively drive best practice, proactively pursued continuous improvement rather than reacting to crisis/ "fire fighting" and utilised the ideas of production operators to assist management. Often a change of leadership is associated with the success of best practice.

b. Customer Focus

Customer satisfaction is usually the key factor that identifies the need for change (Anon. 1994b).

Consumer preferences have significantly shifted over the last two decades, consumers are demanding more specialised and customised products. This has meant niche markets have become more important in creating opportunities. The most successful organisations are committed to getting close to their customers and winning organisations have products that are tailored to customers needs. Strong relationships must be forged with customers (Anon. 1994c)

Hammer et al., (1994) states that sellers no longer have the upper hand the customer does. Customers demand more products and services designed to their unique and particular needs. Customers demand they be treated individually. In the service area, customers expect and demand more because they know they can get more. Adequate is no longer good enough.

Successful organisations anticipate, identify, respond to and satisfy their external customers. These companies reinforce the importance of external customers throughout its operations, it develops and improves its external customer interface processes and seeks improved customer satisfaction and loyalty (Anon. 1994d). Hammer et al., (1994) believes that employee beliefs should be based around that as the customer pays all our salaries, we must do what it takes to please them.

Customers are also a key source of information for innovation, research and development. Having access to a diverse range of market orientated information and ideas about new products and processes and ways of doing business is critical to successful organisations. The sort of information required includes new products and processes, price, new markets, competitor offerings and business system developments (Anon. 1994b).

Carr et al., (1995) identifies the major customer processes as:

Process Name	Definition
Customer acquisition:	Work involving, finding, qualifying, pitching and closing new customers.
Customer migration:	Developing new business with current customers.
Order entry and fulfilment:	Delivering on our bargain with a customer.
Inquiry and complaint handling:	Customer initiated contact after sale.
Local market opening:	A concerted response by geography.

Leading-edge customers are regarded as forward thinking and respected organisations by their own industry. They have a good understanding of their own needs and those of the market, they raise the expectations of suppliers on cost, quality, time and customer responsiveness. Leading-edge customers tend to be more demanding, more sophisticated, less conservative and more advanced. Organisations should work hard to establish and maintaining a close relationship with these customers (Anon. 1994b).

c. Policy and Planning

Organisations must generate guiding values and these values must reflect quality principles. Organisations must translate policy through the planning process and implement them in their daily operations. The planning process must involve the entire organisation, its customers, suppliers and external community (Anon. 1994d).

Carr et al., (1995) believes the policy and planning should be developed from customer research, competitive analysis, benchmarking, financial review, operational review, information management review, assessment of key performance indicators and organisational culture assessment. The major emphasis should be on the customer.

Planning for customer requirements, suppliers capabilities and the needs of other stakeholders should be incorporated into the planning process (Anon. 1994a).

d. Information and Analysis

It is important that data is selected, collected and analysed so sense can be made of the internal and external environment. The information system supports a responsive, prevention and improvement based approach to management. Accurate data is used to demonstrate the achievement of the organisations objectives (Anon. 1994d).

Leading companies must be proactive in obtaining accurate information from leading-edge customers, suppliers, research and development providers and other industry linkages (Anon. 1994b). It is only through the use of information from these sources that an organisation can be innovative.

e. People

Identifying the right people to work as "top-notch" teams is important in a flatter organisational structure. Right people will have creativity, vision and openness to innovation, the team leaders should be selected because they were "champions of change". Team members must have expertise, be a stakeholder, have authority, be creative thinkers, have project management skills and be a team player (Carr et al., 1995). The empowerment of employees to work in self managed teams enables cultural changes across the whole organisation.

Effective teams have communication that goes both ways, members openly and accurately express all ideas, team members share participation and leadership, decision making procedures are appropriate for the situation, Constructive controversy and conflict enhance the quality of decisions the team make and members evaluate the effectiveness of the team and decide how to improve its performance (Carr et al., 1995).

Organisations should align its people objectives with other company objectives (Anon. 1994d).

f. Quality of Process Product and Service

Australian leading companies identified quality from a range of outcomes (cost, quality, timeliness and product innovation) as contributing the most to the leaders success (Anon. 1994a).

Quality involves closer relations with suppliers to contribute to cost, quality, reliability and timeliness of input delivery. Suppliers can enable lead organisations to identify opportunities to capture value through innovative changes to their business systems. In addition, cooperation in developing product specifications gives suppliers an incentive to raise

their sights above cost to improve product design and performance (Anon.1994a and Anon. 1994b).

Only one quarter of emerging exporters rate the performance of their Australian suppliers of raw materials and immediate goods as better than that of overseas suppliers (Anon. 1994b)

g. Organisational Performance

Organisational performance describes how key performance indicators and other measures are used by the organisation. Financial targets and objectives, internal processes and products and services considered vital to the success of the organisation would all have key performance measures to monitor their progress against the baseline benchmark or budget outcomes (Casey, 1995).

2.3.1 Performance Indicators

Performance indicators are used to provide continuous feedback for management and staff on how the organisation is progressing towards the achievement of the goals established for the business, information required for forecasting of future activities and priorities and feedback to special project teams on the effects of their efforts to improve given processes in the workplace or customer satisfaction (Casey 1995).

The four key performance areas in most businesses are customer satisfaction, profitability, growth and sustainability and staff satisfaction. Key performance indicators for the meat industry might be:

1. Customer satisfaction
2. Increase in meat sales
3. Change in price per Kg

4. Change in operating cost
5. Customer buying habits
6. Staff satisfaction

2.3.2 Continuous Improvement

Continuous improvement of small may not be enough to make the processes of best practice successful (Carr et al., 1995). For this reason both Carr et al., (1995) and Hammer et al., (1994) advocate the use of reengineering in the initial stages of best practice to participate in larger gains and expose the organisation to less risk of implementation failure.

Continuous improvement must involve the use of measurement to be able to accurately assess the changes. Continuous improvement should be driven by the customer, therefore an ongoing assessment of their satisfaction level is important.

Selecting only the right processes for improvement is important, if too many processes are initiated without proper resources then the program may be exposed to a high level of risk of failing.

Carr et al., (1995) describes continuous improvement as shorthand for a style of quality management built around the goal of raising customer satisfaction through continuous process improvement. Best practice must be sustainable and improve on breakthrough gains. Continuous improvement may be gained by involving customers and suppliers, teams and ownership, rewards, delegation of authority, feedback and ideas from employees.

2.3.3 Benchmarking

Benchmarking is an ongoing, systematic process to search for and introduce international best practice into your organisation, conducted in such a way that all the parts of your organisation understand and achieve their full potential. The search may be of products, services or business practices and processes, of competitors or those organisations recognised as leaders, in industry or specific business processes that you have chosen (Anon. 1993e).

Characteristics of the process include, involving the right people (workforce), choosing the right things to benchmark, having a common understanding of just what is involved, gaining a thorough understanding of your own situation, choosing suitable partners and turning ideas/ lessons from visits into practical improvement projects and managing the improvement projects to fruition (Anon.1993e).

The types of benchmarking are included in table 2.3

Table 2.3a: Types of Benchmarking.

	Numbers	**Processes**
Internal	performance	functional
External	competitive performance industry	functional generic process industry

Table 2.3b: Types of Benchmarking: Advantages and Disadvantages

Type of Benchmarking	Example	Advantages	Disadvantages
internal	Comparison within your organisation of same activity carried out in other divisions or locations (eg. McDonalds Aust with McDonalds USA; Visyboard box plant in Victoria with box plant in NSW).	* Easy to find partners	* Need to take care with performance measurement. Definitions which may appear to be common are often misleading. * Narrow focus "same family" generally means opportunities for break through improvements are missed. * Internal politics may cause reluctance for genuine information sharing.
external (competitors)	Comparison with companies in same markets with competing products or services (eg. Coke vs Schweppes, Coke vs Pepsi).	* Clear focus on what your related performance is. * An effective attention grabber, especially for senior management.	* Difficult to gain agreement to share information. * Information available tends to be high level; tends to show where rather than how to improve business performance. * Comparing with others, all in the same industry may limit creative solutions.
external (same industry)	Comparison with same products or services but not competing in same markets. eg. Billing process of Telecom Australia vs Billing process of British Telecom.	* Easier to identify partners. * Better chance of open sharing of information. * Easier to see analogies with your own situation.	* Still tainted somewhat with the "same industry" mindset; this limits the chances of 'breakthrough' gains

external (generic)	Not in same industry. However have the need to carry out a similar process effectively. (eg. A car company benchmarking its new product development process with that of a consumer electronics company).	* The greatest opportunity for 'earth shattering' improvement ideas that will give competitive advantage. * Few concerns about giving away competitive information.	* Hardest to locate partners who have something of use to you. * Hardest to recognise the 'earthshattering' improvement idea when you see it. * Hardest to incorporate into your own business processes in a practical way.

An internal benchmark should be carried out first, this enables a baseline of the process, service or product to be attained. Then you should select the most appropriate external benchmark and focus primarily on operating processes and quality procedures. Benchmarking of the more qualitative areas, such as customer service requires the experience and maturity from an ongoing commitment to the benchmarking process (Anon. 1994a).

2.3.4 Quality Alliances

Quality alliances involve relationships with both customers and suppliers. The feedback from customers should drive all of the processes of the business. The key strategies for quality alliances has been outlined by Casey (1995):

1. Determine the key needs of each business and the current level of performance as perceived by the direct customer.

2. Develop the model for quality agreements using the results of the survey as the basis for the initial agreement. Formally launch the concept of quality agreements with the key customers and suppliers involved in the network.

3. The first six months will provide common feedback to all partners in the network on performance in common areas identified in the initial survey.

4. Teams comprising customer service staff will further negotiate specific agreements.

5. Evaluate the performance agreements and establishment of continuous improvement teams to ensure the customers needs are met.

2.3.5 Common Errors or Barriers to Improved Performance

Hammer et al., (1994) and Anon. (1994a)

* Ability to implement change, especially at middle and senior management levels.

* Availability of skilled people.

* National infrastructure costs.

* Exchange rate fluctuations.

* Compliance culture, this is when the minimum becomes the maximum.

* Don't focus on business processes.

* Ignore everything except process design.

* Neglect people's values and beliefs.

* Be willing to settle for minor results.

* Allow existing corporate cultures and management attitudes to prevent best practice from getting started.

* Try to make best practice work from the bottom up.

* Assign someone who doesn't understand best practice to lead the effort.

* Skimp on resources devoted to best practice.

* Bury best practice in the middle of the corporate agenda.

* Dissipate energy across a great many best practice projects.

* Fail to distinguish best practice from other business improvement programs.

* Try to make best practice happen without making anybody unhappy.

* Pull back when people resist making best practice changes.

* Attempt to implement best practice when the C.E.O. is two years away from retirement.

2.4 CONCLUSION

Best practice is now widely implemented within manufacturing companies in Australia. The procedures have been fine tuned with an emphasis on the export market. However, there has been little adoption of best practice within the food service industry, with virtually no acceptance in the beef products segment of this industry.

The main thrust of implementation has occurred through the involvement of people within the medium to large organisations. The food service industry is segmented into categories ranging from companies with thousands of staff, e.g. Sizzler and McDonald chains, down to the small restaurant staffed by a single family.

The procedures outlined in Chapter 3 have been written to take account of the various differences between companies within the food service industry and will act as a blue print that will allow the use of particular facets of the procedures to be adopted by individual food service companies or outlets.

Chapter 3: BEST PRACTICE PROCEDURES FOR CONTINUOUS IMPROVEMENT IN A RED MEAT STRATEGIC ALLIANCE

3.1 SUMMARY

The decline in per capita consumption of red meat within mature markets of developed countries has been attributed to a complex of reasons associated with changes such as lifestyle and price relativity of competing meat products. The opportunities to increase red meat profits in mature markets will be undertaken by those firms which adopt Best Practice principles and Strategic Alliance networks that focus on accurately identifying and improving consumer satisfaction. This continuous improvement process accurately delivers efficiencies and a consumer focus to all members of the Strategic Alliance market chain. These principles of Best Practice enable all Strategic Alliance members to be continually responding to the changing needs of the actual demographic consumer.

3.2 INTRODUCTION

Numerous reasons have been put forward for the decline in red meat sales in various countries. In the U.K., Richardson, et al. (1994) identified concerns of healthiness, taste and the use of additives as the major factors associated with a 28% decline in meat consumption. Harrington (1994) identified changes in lifestyle, affluence and family fragmentation as contributing factors. In South Africa, Rubbe (1991) identified controlled marketing and price as constraints to increased consumption of red meat. In Australia, Gorny and

Akmadi-Esfakani (1993) found no change in consumer purchasing habits between 1987 to 1991, in response to either health, lifestyle, promotion or seasonal change, indicating that the change to chicken was primarily price driven. In contrast to western countries, red meat sales are increasing in some Asian and South America countries GATT (1994).

In an attempt to stem the decline in red meat sales in the US, Cross and Saville (1993) identified the need for clear signals from the consumer through the whole marketing chain to the producer, although rarely does such a link exist. Most emphasis to date has focused on the human health aspects through the production of closely trimmed retail cuts. Despite the national trends in declining consumption in many western countries GATT (1994), there are examples of clear anomalies in that individual companies are gaining market share and improving profitability on their competitors, while a number of industry based initiatives are having little impact on red meat sales. The major reason for these successes is that the companies have become consumer focused at the corporate and individual outlet levels (Womack et al., 1990 and Carr et al., 1995). The complexity of the issues involved in dealing with the consumer require an individual wholistic business approach, rather than a generic solution. The combination of Best Practice and Strategic Alliances is one way leading firms can accurately identify consumer requirements and develop individual procedures that deliver changes that have been identified to enhance profitability of the business (Casey 1995).

This paper reports some of the procedures which have been used to implement Best Practice and Strategic Alliances within the supermarket, retail butcher, food service, institutional and hotel/restaurant sectors of the Australian red meat market. These principles are used with individual modifications to suit the various leading firms and customer requirements.

3.3 METHODOLOGY/PROCEDURE

Best Practice is a comprehensive, integrated and co-operative approach to the continuous improvement of all facets of an organisations' operations. It may involve the forming of Strategic Alliances between partners to enhance the management and operational expertise of the organisation (Anon. 1993e). Benchmarking is used to objectively search competitors, those organisations recognised as leaders in the industry, or specific business processes of products, services or business practices which allow identification of marketing and business opportunities. The procedures for the leading firm of the market chain are as follows:-

3.3.1 Leading Firm Procedures

Anon. (1993e); Anon. (1994b) and Carr et al., (1995) have identified that the accurate assessment of customer satisfaction and purchase requirements are key performance indicators in the profitability of a business. They outlined the importance of internal and external benchmarking of clients. Internal benchmark surveys of existing customers were first carried out to determine consumer requirements, preferences, buying behaviour and demographics. For retail butcher shops and supermarkets, these surveys were conducted by interviewing customers both at the point of sale, and by take-home surveys completed after the meat has been eaten. In food service, hotel and restaurant outlets, internal benchmark surveys were conducted using their own patrons. As part of the internal benchmark evaluations, meat colour, fat colour, marbling, fat content, portion weight, cut dimensions were objectively assessed using the VIASCAN Portion Assessment System (Gordon, 1994), pH using a pH meter and texture/firmness subjectively assessed on a range of beef and/or lamb cuts from the leading firm. This product was then tasted using sensory panels established and trained in

each leading firm. External benchmarks (Anon. 1993e) were then conducted using shoppers which frequented the same shopping centres and food outlets (i.e. competitors' customers), and beef and/or lamb cuts from each of the major competitors tested using the objective and subjective assessments and the sensory panel.

After analysis of the benchmark surveys, the results were discussed with the leading firm and a general set of performance indicators developed to focus on the key issues identified and to allow on-going measurement of improvement (Casey 1995). The analysis of the benchmark results provided the basis for defining consumer requirements in objective terms, identified competitive strengths and weaknesses of the leading firm and pointed to new marketing and management opportunities (Anon. 1994a and Carr et al., 1995). New product specifications were developed and the implications of these specifications discussed between all members of the Strategic Alliance (Anon. 1994a and Anon. 1994b).

Pilot trials, involving all members of the alliance (Casey 1995), have been undertaken to implement the objective measurement and quality assurance programs necessary to deliver product consistently meeting the new objective specifications, assess the ability of suppliers to meet the specifications, and test the quality of the retail product using objective measurements and sensory tests. In some cases a number of iterations were required to further refine specifications, to reach the level of product quality and consistency required by consumers. Marketing strategies were developed with marketing and management personnel to support the introduction of the new product specifications and to exploit clearly identified opportunities for improving consumer satisfaction.

When all parties to the alliance were satisfied with their ability to trade on the basis of the new product

specifications and accept the price structure, volumes, service standards, hygiene and health requirements specified by the leading firm, then a Quality Alliance Agreement was developed (Casey 1995). This was written between all members of the alliance, and is essentially a risk management process to forward contract for supply of a given volume and quality of product over a specified period of time at a specified price.

Monthly consumer surveys and product testing continues on an ongoing basis to assess any change in consumer needs (Carr et al., 1995). At the outset, training was provided to leading firm personnel and representatives from their supplier organisations (Dertouzos et al., 1989) on the conduct of sensory panels, and the use of advanced new and existing technology (Dertouzos et al., 1989) such as the VIASCAN equipment, so that these employees could take total responsibility for ongoing performance evaluation. Feedback mechanisms and reporting structures were established to provide all alliance members with information on the level of consumer satisfaction with their product (Casey 1995). All performance measures are analysed on a regular basis and reports provided to all participants.

3.4 CONCLUSION

The Best Practice and Strategic Alliance procedures outlined in this paper have been successfully implemented in supermarket, retail butcher, food service, institutional and hotel/restaurant sectors of the Australian red meat market.

The procedures outlined above form the basis of the methodology for the research chapters 4 and 7 of this thesis. Naturally, individual situations will require variations to these procedures, however, they contain the major procedures that have demonstrated beneficial change within some red meat end user companies within Australia.

Chapter 4: QANTAS FLIGHT CATERING LIMITED MEAT ENHANCEMENT PROGRAM

A Benchmark For The Beef And Lamb Industries.

4.1 INTRODUCTION

Q.F.C.L. is one of the largest food service companies in the southern hemisphere with catering centres in Sydney, Melbourne, Brisbane, Adelaide and Perth. These catering centres produce approximately 14 4 million meals and service more than 75,000 aircraft movements per annum, for more than 30 international and Australian airlines, as well as the State Railways of Queensland.

Each customer has special and unique requirements. No two airlines want the same requirements. Most design their menus to reflect their national culture.

The Qantas Flight Catering Limited (Q.F.C.L.) meat enhancement program was initiated in 1992 in response to the increasing customer complaints both within the Qantas group and from International airline company customers.

With beef prices in Australia lower than overseas, International airline companies viewed the inclusion of beef meals as an opportunity to deliver a universal meal to meet customer desire at an affordable price. However in practice, while the affordable price was maintained an increasing number of customer complaints were being registered. Q.F.C.L. responded by changing supplier with the new supplier putting forward new improved product. After a very short period the complaint levels were increasing again, this inturn meant changing supplier and so the merry-go-round effect occurred.

Q.F.C.L. embarked on a best practice program to improve customer satisfaction for all their services. The adoption of this oppo tunity to combine best practice principles with the meat enhancement program was carried out across the five catering centres in Australia.

The Q.F.C.L. meat enhancement program was developed as a baseline study on a wide variety of beef and lamb products used in the airline catering industry.

The airline catering industry is coming under increasing competition from existing competitors eg. Ansett and new co npetitors eg. Caterair and Cathay Catering. The current economic climate is pressuring customers to demand more while wishing to pay less.

Q.F.C.L.'s customers are primarily international airlines, who purchase catering throughout the world. Q.F.C.L.'s performance is compared not only with the local competition but with the standard of catering services customers receive overseas.

4.2 METHODOLOGY

There were two forms of methodology used in the Q.F.C.L. meat enhancement program. The first involved all the best practice procedures and the second pertained to the actual materials and methods of the product sampled.

4.2.1 Best Practice Procedures

The targeted best practice principles used were:

* Leadership - Strong level of commitment and vision. The ability to identify and give responsibility to teams and individuals that can deliver change, "change agents".

* Customer Focus - Benchmarking customers and catering centres around the world. Development of cabin crew training and meal reheating specifications. This

included surveying 1,780 passengers and 15 international catering centres. Passengers were surveyed at the time a main red meat meal was served. Questions on tenderness, juiciness, overall satisfaction, percentage of meat eaten were included.

* Closer Relations With Suppliers - Development of training and specifications with suppliers. Development of Quality agreements with suppliers. Identify committed and skilled suppliers that can deliver consistently to specifications. Feedback of subjective and objective performance criteria. Communications both from Q.F.C.L. to suppliers and from suppliers to Q.F.C.L. were developed.

* Improved Processes - All specifications were written in AUSMEAT language. Suppliers add value to beef and lamb product lines. The use of pH meters and Video Image Analysis equipment (V.I.A.).

* Performance Indicators - Quality standards (specifications and wastage rates), competitive pricing (tendering process), service standards and hygiene standards. Labour savings, cooking time savings and specification wastage savings were all carried through time and motion studies under commercial conditions.

* Improvement In Staff - Development of trained meat teams within each catering centre to monitor quality, update specifications and deliver meat products to or above customers requirements.

* Continuous Improvement - Ongoing surveys, quality agreements, national sourcing of product, monthly sensory testing by trained taste panels and feedback to suppliers and customers.

The processes of continuous improvement were:

1. Monitor customer requirements.

2. Develop product lines and specifications.
   - Customer, Q.F.C.L. meat teams and suppliers.
   - AUSMEAT language.
   - Cooking technique: part cook/ chill/ reheat.

3. Develop hygiene standards for all catering centres and suppliers.

4. Purchasing process and feedback. The tendering process sets competitive pricing, communicates specification and enhances communication between Q.F.C.L. and suppliers.

5. Quality control and monitoring:
   - Receival - temperature, hygiene, pH and cutting lines.
   - Butchery section - specifications.
   - Random V.I.A. monitoring.
   - Monthly taste test performance.

6. Development of inflight cooking manuals.

7. Monitor customer feedback and respond when required. Any customer complaint mentioned inflight to a flight attendant is recorded in a voyage report. This report is then passed to the Marketing Department of Q.F.C.L. Each complaint is acted upon by a written reply. If warranted, an investigation of the complaint is the

responsibility of the Marketing Department. Customer complaints received directly to Qantas Airlines are also passed onto the Q.F.C.L. Marketing Department.

4.2.2 Measurements

700 beef and 430 lamb samples were assessed for taste, tenderness and overall satisfaction by trained Q.F.C.L. sensory panel ists. All panellists were chefs or purchasing personnel employed by Q.F.C.L. at various catering centres around Australia.

Ten beef and ten lamb product lines were assessed. The results reported are for all beef or all lamb unless identified. The main product lines tested were beef tenderloin (fresh and frozen) steaks preportion prepared in classes varying from 50 grams to 700 grams, beef and veal striploin (fresh only) and beef knuckle (fresh only), the number assessed in each product line are included in table 4.2. Lamb product lines and numbers assessed are included in table 4.2A. All lamb product lines were delivered fresh except lamb noisettes where both fresh and frozen were assessed.

Samples assessed may of been sourced from normal production and randomly sampled or from tendered samples. Both production and tendered specifications were identical for each product line.

The samples assessed were sourced from the thirteen main beef and lamb suppliers to Q.F.C.L., all other suppliers have been grouped together as "other suppliers".

All samples were assessed for the following:

- Specification requirements,
- pH and V.I.A. measurements and
- Sensory results.

The comparison of fresh versus frozen product was only carried out on commercial product lines supplying both fresh and frozen samples. The results taken no account for thaw loss as all frozen samples are cooked frozen.

4.2.3 Cooking Procedure

The raw beef and lamb samples were assessed against Q.F.C.L. specification sheets (appendix 2 illustrates a typical beef and lamb specification), pH and V.I.A. measurements were taken at the same time the product was assessed against specification. This product was then prepared in identical circumstances to normal commercial production. The product was first partly cooked to medium rare then chilled to 0 degree Celsius and then reheated at 180 degrees Celsius for 15 minutes. This process replicated the cooking and reheating process for economy and business class steak and preportioned lamb dishes.

After cooking, samples were cut in triangle wedges (pizza style) so each sensory panellist received some product from both he middle and outer portions of each sample.

Sensory panellists filled out separate result sheets for each sample. Panellists often assessed product at other catering centres to maintain accurate scoring and when large numbers of tendered samples had to be assessed.

pH measurements were taken using a Jenco microcomputer pH meter model 6007 and a Ionode meat probe IJ42. The V.I.A. equipment used was developed by the Meat Research Corporation of Australia. This equipment assesses the meat and fat colour values of red, green, blue, hue, saturation and intensity, the dimensions of diameter, length, width and perimeter and the white pixels which allows assessment of the marbling and fat percentages on the face of the product.

4.2.4 Statistical Analysis

Systat V5.03 has been used to perform all the statistical analysis. The aim of this section is to give a brief overview of the statistical procedures used.

T-Tests

The t-test has been used in the case where there are two groups (for example, fresh versus frozen). The question being asked is whether there is a difference in the various attributes between these groups. For example, is there a difference in the sensory scores between fresh and frozen products?

The t-test compares the means of the two groups of cases. This method is based on the assumption that the two groups have equal variances. There is some leeway in this assumption when sample sizes are large (30 cases is usually considered as large). Systat prints out a "pooled variances t-test" and a "separate variances t-test". The latter is appropriate when the equal variances assumption has been violated. Only the relevant "t-test" has been included in this report.

If there was a difference between the two groups of cases, the "PROB" value will be below 0.01. If the "PROB" was above this figure, there is no statistical evidence to show that there is a difference.

Analysis of Variance

Analysis of Variance (ANOVA) is an extension of the "t-test". Instead of testing just two groups, ANOVA is used when the difference (if any) is being analysed between many groups - such as suppliers, product lines etc. The underlying assumption of this procedure is that the population distributions are normal with equal variances. This assumption has been verified before the test was applied. If there is a difference between populations, the "P" value will be below 0.01. If this is the case, a "post hoc" test has been applied to ascertain where the differences lie ANOVA merely tells if there is a difference, but post hoc (Tukey HSD) will detail where the differences are. The post hoc results have not been included in the report as the "Bar Graph" usually displays the same information. Individual

models were run for separate treatment effects.

Bar Graphs

The Bar Graph shows the average of a particular attribute grouped according to the supplier, product etc. A line above each bar in the graph shows the standard error about the mean for the particular group.

The Bar Graph has been included in the report where it was found that there were differences in attributes between groups.

Regression Analysis

Regression analysis was used to determine whether any relationships existed between the pre-cooked measurements of the meat and the cooked results. The following procedure was used:-

1. Graph: The cooked results were graphed individually against the various raw measurements. If it appeared that a relationship existed, Step 2 was completed.

2. Regression: This involved fitting a line on the graph to describe the relationship between the variables in question. This "line" may have been linear or curved depending on the results from the graph. If the relationship fitted was significant, "P" value was below 0.01.

3. Assumptions: Residual analysis was conducted to ensure the fitted model adhered to the various assumptions associated with regression analysis.

4.3 RESULTS AND DISCUSSION

Customer complaint levels have dropped by 96% for beef and lamb products over the period from the first six months of 1992 to the first six months of 1994.

Customer survey results from 15 catering centres around the world have illustrated the high degree of variation in the delivered degree of doneness of beef and lamb. All airline cooking manuals for business and economy class describe that beef and lamb meals should be cooked to a medium degree of doneness. However, the delivered degree of doneness varies greatly with consumers rating 10.8% rare, 21.5% medium/rare, 44.6% medium, 13.9% medium/well done and 9.2% well done.

There was no significant difference between the degrees of doneness and consumer overall satisfaction. There was a small significant difference between the medium/rare and well done, medium/rare and medium/well done and medium and well done for tenderness ($P<0.05$). However, there was no difference between all of the other combinations. There was no significant differences between the degrees of doneness and juiciness except for the degrees of rare and well done ($P<0.05$).

Other efficiency improvements are included in table 4.1.

Table 4.1: Efficiency Improven ents During The Program Period.

PRODUCT	LABOUR SAVING %	CO)KING TIME SAV'ING %	NET $ SAVING/KG	WASTAGE SAVING %	NUMBER OF STEAKS CUT INCREASED%
Beef Striploin (Netted)		18%		75%	
Beef Striploin	49%		$1.06/kg	50%	
Beef Tenderloin				5%	30%
Veal Striploin				12%	5%
Lamb Back			$0.08/kg	58%	
Lamb Leg Boneless	-38%			12%	
Lamb Loin Boneless				100%	

These efficiency and pricing improvements were created by receival of more consistent product, adherance to specifications, more value adding being carried out by suppliers and improved workmanship with Q.F.C .L. catering centres and suppliers' premises bytraining.

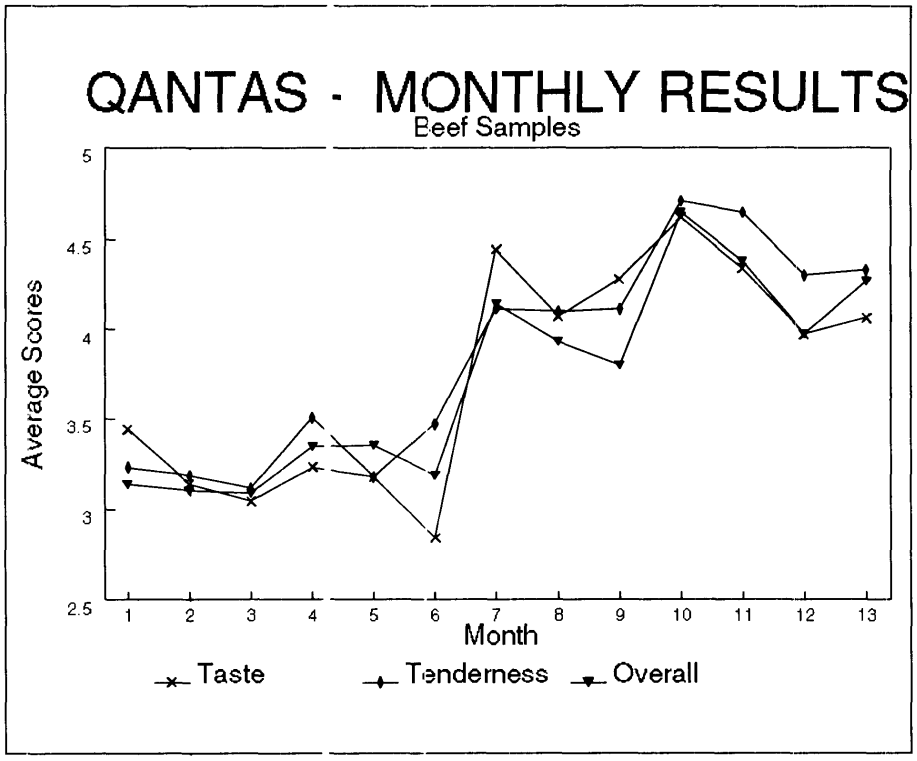
4.4 BEEF

4.4.1 Trends Over Time

The trends over time were studied at Sydney, Melbourne and Brisbane. These centres have been chosen as testing has actually been conducted consistently over 13 months at these centres.

In order to analyse trends over time, data has been classified and grouped according to the month number of testing at each centre. Month 1 served to set the benchmark for trends studied. The benchmark sensory scores for taste, tenderness and overall satisfaction were 3.4, 3.2 and 3.1 respectively. Over the last six months, (Months 8 - 13 inclusive), the taste, tenderness and overall satisfaction scores were 4.3, 4.4 and 4.2 respectively. The average of the three sensory scores of taste tenderness and overall satisfaction rose by 24%, 36% and 34% respectively ($P<0.01$). The movement of the average sensory scores over the 13 months of testing is shown in graph 4.1.

Graph 4.1: Monthly Results For Beef Sensory Scores.

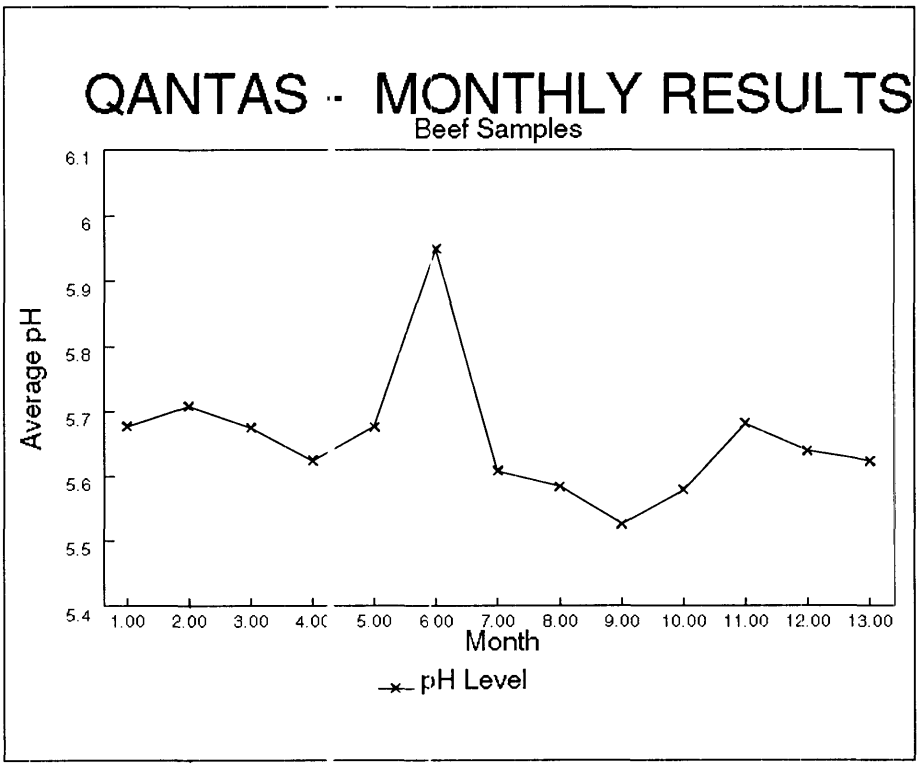


This graph clearly shows that the level of cooked scores are in two distinct groups. In Month 1 to Month 6, the scores generally hovered between 3 and 3.5. After Month 6, the scores jumped up to around 4 to 4.5 and generally stayed around this mark.

The nature of this graph can be explained by the tendering process conducted in the sixth month of testing at each centre. Clearly the tendering procedure had a positive effect on the cooking scores.

The pH benchmark mean for beef was 5.68, over the last six months this had dropped to 5.60 ($P<0.05$). The average monthly means for pH are included in graph 4.2.

Graph 4.2: Monthly Results for pH Levels.



The level of pH hovered around 5 7 until Month 6. The sharp rise in Month 6 is due to the tendered samples included in this month. After acceptance of the better tenders, the pH levels dropped to around 5.6.

The mean meat intensity colour scores demonstrate the improvement in meat colour, when comparing the last six months to the benchmark score, 59.7 and 52.5 respectively ($P<0.05$).

However, the cooking loss percentage increased from a benchmark of 20.3% to 21.1% for the last six months - although the difference was not significant (P>0.05).

4.4.2 Product Lines

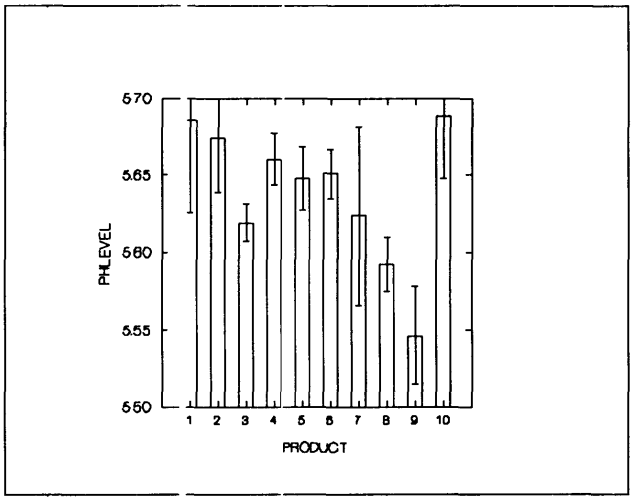
There were 10 beef product lines assessed and sample numbers, these are identified in Table 4.2.

Table 4.2: Beef Product Lines and Sample Numbers Assessed.

TABLE OF PRODUCT (ROWS) BY CENTRE (COLUMNS)	Brisbane	Melbourne	Sydney	TOTAL
50-60g fillet	4	2	12	18
90-100g fillet	5	0	35	40
120g fillet	25	43	70	138
150g fillet	11	27	44	82
700-900g fillet	0	5	14	19
Tenderloin	8	15	33	56
Tenderloin Piece	0	5	0	5
Striploin	13	27	48	88
Striploin Netted	3	0	19	22
Knuckle	0	4	15	19
TOTAL	69	128	290	487

There was a significant difference in the pH levels between the ten product lines (P<0.01). Graph 4.3 highlights the means and standard errors for the ten product lines.

Graph 4.3: pH Means And Standard Errors For The Ten Beef Product Lines at Sydney, Melbourne and Brisbane

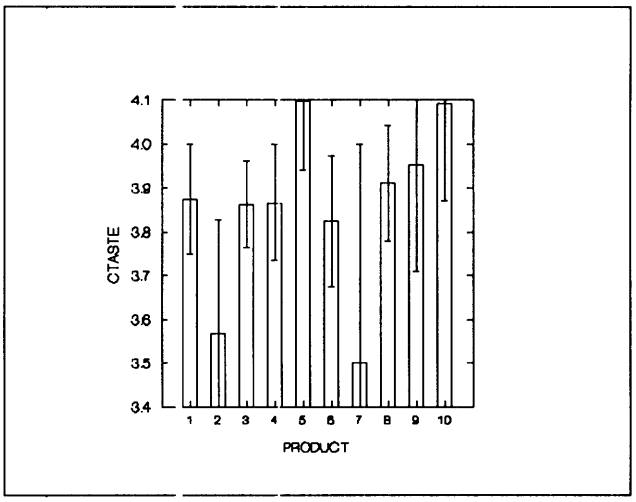


Products 1 to 7 are from the tenderloin, products 8 and 9 from the striploin and product 10 is the knuckle.

* See appendix 1 for product line identification.

There was a significant difference in the taste scores between the different product lines (P<0.05). Graph 4.4 demonstrates the means and standard errors for the various fresh beef product lines.

Graph 4.4: Taste Scores For The Various Fresh Beef Product Lines at Sydney, Melbourne and Brisbane.

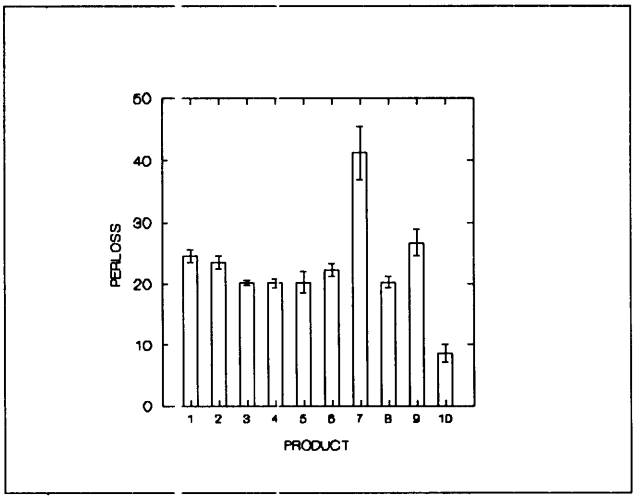


* See appendix 1 for product line identification.

There was no difference in tenderness and overall satisfaction scores when products were assessed as individual product lines, P>0.05 in both instances.

The percentage cooking loss between the various beef products was significant (P<0.01). Graph 4.5 demonstrates the variation between beef products.

Graph 4.5: Percentage Cooking Loss For Each Beef Product at Sydney, Melbourne and Brisbane.



* See appendix 1 for product line identification.

4.4.3 Fresh And Frozen Products

Only the 50g-60g, 90g-100g and 120g fillet steaks were supplied in both fresh and frozen states. Between the three beef product lines there was a total of 196 samples of which 68 were frozen.

For these three product lines there was a significant difference in the taste, tenderness and overall satisfaction sensory scores between the fresh and frozen products, 3.8 and 3.2 ($P<0.01$), 4.0 and 3.1 ($P<0.01$) and 3.8 and 3.1 ($P<0.01$) respectively.

There was also a significant difference in the cooking loss between the fresh and frozen product, 20.6 and 23.0 respectively ($P<0.01$).

However, there was no difference in the pH levels ($P>0.05$) between the fresh and frozen beef products.

4.4.4 Beef And Veal Products

The striploin was the only product supplied as both beef and veal. There was a significant difference between the beef and veal striploins for taste, tenderness, overall satisfaction and pH, these were 3.5 and 4.2 ($P<0.01$), 3.4 and 4.3 ($P<0.01$), 3.3 and 4.1 ($P<0.01$) and 5.7 and 5.5 ($P<0.01$) respectively.

There was no difference in the cooking loss between beef and veal striploins ($P>0.05$).

4.4.5 Level Of pH

A total of 503 beef and veal samples were pH assessed, of these 93 or 18.5% were above

pH 5.70 (maximum allowable in Q.F.C.L specification) and 17 or 3.4% were above pH 5.9.

If the pH level was below 5.70 for fresh beef products there was no significance on overall satisfaction scores. However, when samples with pH levels above 5.80 were grouped together, the overall satisfaction score was significantly affected ($P<0.05$).

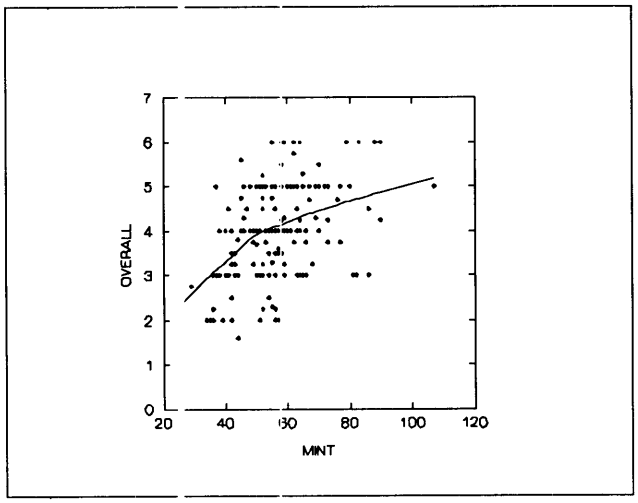
The frozen beef product results were different to the fresh results with the higher pH levels resulting in higher overall satisfaction scores ($P<0.05$).

There was a strong correlation between the overall satisfaction score and the taste and tenderness scores of $r=0.825$ and $r=0.869$ respectively.

4.4.6 Meat Colour

Meat colour has been assessed by using the V.I.A. meat colour intensity score. Using a lowess curve it was possible to predict an intensity cut-off point to group data for analysis as shown in Graph 4.6.

Graph 4.6: Relationship of pH and Overall Score for all Fresh Products



If beef had an intensity score below 50 (darker in colour), meat intensity had a greater

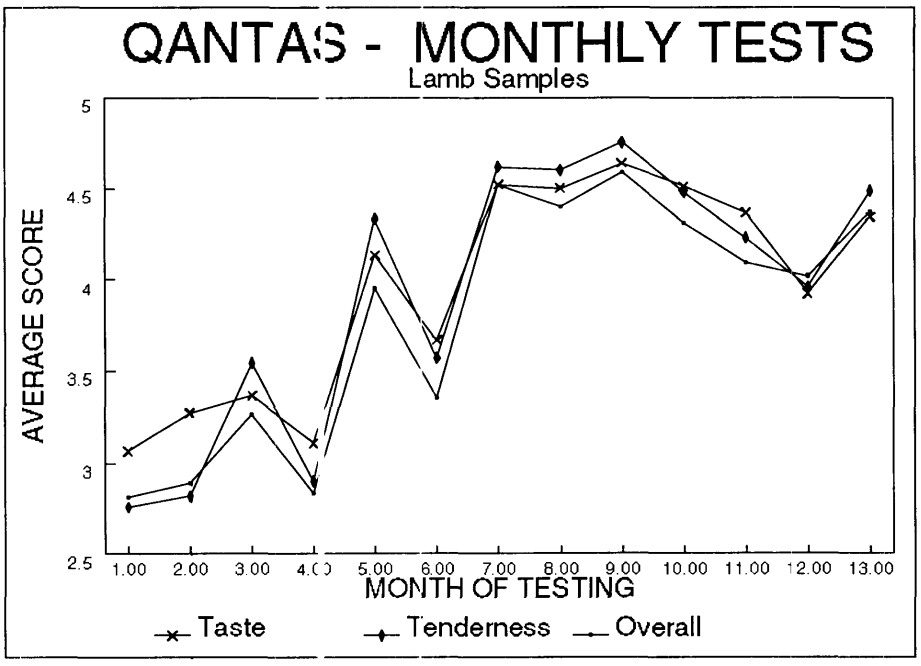
effect on the overall satisfaction score ($P<0.01$ and $R^2 = 0.281$) than beef above an intensity score of 50 (lighter in colour) with $P<0.01$ and $R^2 = 0.060$). A beef intensity colour score of 50 equates to the cut-off between AUSMEAT meat colour scores 2 and 3.

4.5 LAMB

4.5.1 Trends Over Time

There was a significant difference between the benchmark sensory scores for taste, tenderness and overall satisfaction 3.1, 3.0 and 2.8 respectively and the results of the last six months, 4.5, 4.4 and 4.3 for taste, tenderness and overall satisfaction respectively ($P<0.01$). The pH levels dropped significantly over the same time frame, 5.82 and 5.69 ($P<0.01$). The standard deviations also declined over this time frame for taste, tenderness, overall satisfaction and pH: 1.3 and 1.0, 1.6 and 1.0, 1.3 and 0.9 and 0.20 and 0.18 respectively, resulting in less variation. The sensory monthly means are demonstrated in graph 4.7.

Graph 4.7: Monthly Lamb Sensory Scores



4.5.2 Lamb Product Lin es

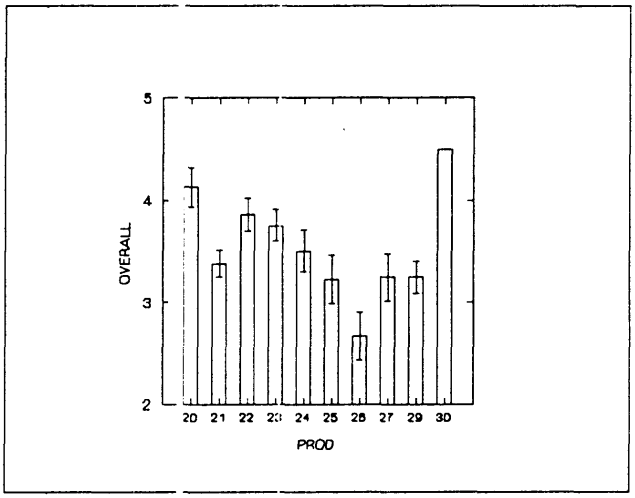
Ten lamb product lines and three hundred and thirty six samples were assessed. These are identified in Table 4.2a.

Table 4.2a: Lamb Product I ines and Sample Numbers Assessed

TABLE OF PRODUCT (ROWS) B Y CENTRE (COLUMNS)				
	Brisbane	Melbourne	Sydney	TOTAL
Lamb Rack	1	12	22	35
Lamb Noisette	12	31	36	79
Lamb Cutlet	25	0	24	49
Lamb Backstrap	13	13	28	54
Lamb Leg	0	7	27	34
Lamb Loin	0	13	8	21
Lamb Leg Medallions	9	18	4	31
Lamb Fillets	26	0	0	26
Lamb Outside	1	4	0	5
Lamb Tenderloin	2	0	0	2
TOTAL	89	98	149	336

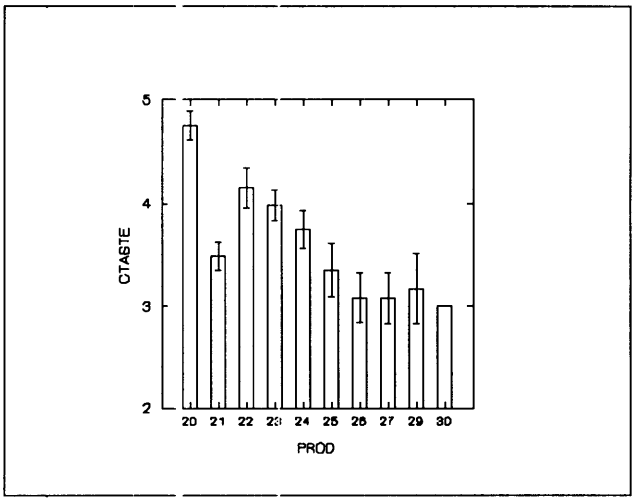
There was a significant difference between the lamb product lines ($P<0.01$) for both pH and the sensory traits of taste, tenderness and overall satisfaction. The variation between the product lines is illustrated in graphs 4.8, 4.9, 4.10 and 4.11.

Graph 4.8: Overall Satisfaction Variation Between Lamb Product Lines at Sydney, Melbourne and Brisbane



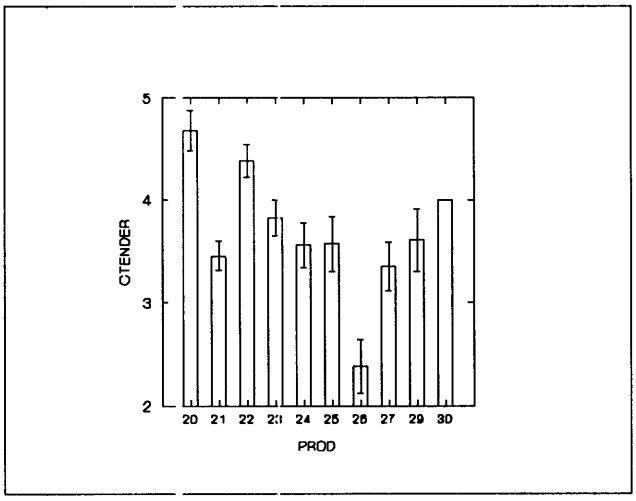
* See appendix for product line codes.

Graph 4.9: Taste Variation Between Lamb Product Lines at Sydney, Melbourne and Brisbane



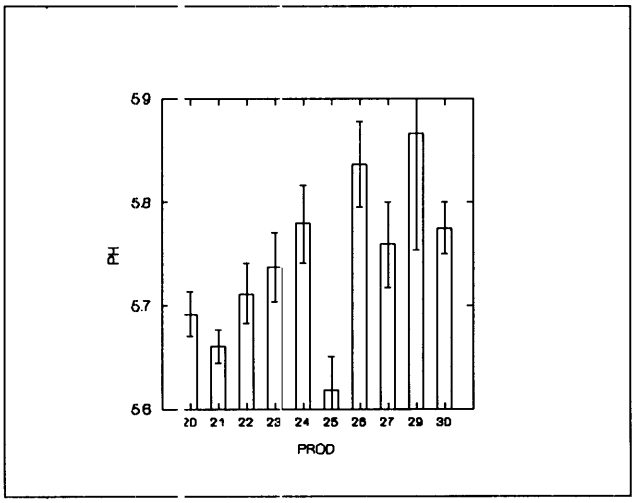
* See appendix for product line codes.

Graph 4.10: Tenderness Variation Between Lamb Product Lines at Sydney, Melbourne and Brisbane



* See appendix for product line codes.

Graph 4.11: pH Variation Between Lamb Product Lines at Sydney, Melbourne and Brisbane.



* See appendix for product line codes.

4.5.3 Suppliers

There was no difference between suppliers for taste, tenderness, overall satisfaction and pH ($P > 0.05$).

4.5.4 Sensory Results

Regression analysis showed that pH was the only independent variable that significantly affected the taste ($P<0.01$ and $R^2 = 0.103$), tenderness ($P<0.01$ and $R^2 = 0.132$) and overall satisfaction ($P<0.01$ and $R^2 = 0.142$) of lamb.

4.5.5 Fresh And Frozen Lamb Noisettes

Lamb noisettes was the only lamb product line supplied as fresh or frozen. There was a significant difference between the fresh and frozen product for taste, tenderness and overall satisfaction, with means of 3.9 and 3.1 ($P<0.01$), 3.8 and 3.2 ($P<0.05$) and 3.7 and 3.0 ($P<0.01$) respectively.

There was no significant cooking loss difference between the fresh and frozen product lines ($P>0.05$). This could be the result of how the assessment was carried out as no account was taken of the thawed loss.

4.5.6 Meat Colour

There was no significance found between lamb colour red, green, blue, intensity, saturation or hue values.

4.6 GENERAL DISCU SSION

The best practice procedures initiat ed by Q.F.C.L. have lead to significant gains in lowering customer complaints, by increasing the taste, tenderness and overall satisfaction sensory scores and increasing the consistency of these products by reducing their variability. In the commercial environment the reduction of customer complaints by 96% is an extremely good result to gain competitive and marketing advantage over competitors. The ability to consistently deliver a product that meets consumers satisfaction is one of the key objectives businesses strive for to maintain and increase profitability.

The variation in delivered perceived degree of doneness by passengers is high considering the tight specifications for weight and dimensions and the standard "part cook /chill and reheat" cooking process. Further research needs to be carried out to identify the degree of doneness variation.

Efficiency improvements are important financial factors to a business, no attempt was made to quantify these actual financial gains across the total Q.F.C.L. catering centres.

The different pH values associated between various product lines is similar to those reported by Lawrie, (1991). These results show that pH was the major objective assessment that lead to changes in taste, tenderness and overall satisfaction of beef and lamb. However, the results between beef and lamb vary, as the pH of beef rises above 5.75 the tenderness decreases, these results are in line with Bouton et al., (1957). The pH effect on lamb tenderness appears to be linear, with the tenderness scores decreasing as pH rises. These results may indicate the use of older animals (eg. mutton) substituted for lamb product lines. It is of interest that the higher pH samples of frozen beef product lines had higher overall satisfaction scores than the lower pH samples, these results are similar to Penny et al., (1963).

The lamb taste results show the same trend as Lawrie (1991) and Bouton et al., (1975) who reported that as the pH rises the taste declines.

Fresh beef and lamb samples had higher taste, tenderness and overall satisfaction sensory scores than samples that had been frozen. The tenderness result reported is at odds with those reported by Penny et al., (1963) where there was no difference in taste panel and objective tenderness scores between fresh and frozen beef.

The sensory scores for tenderness of veal are similar to those reported by Boucek et al., (1961) and Light and Bailey, (1989).
However, the higher taste score for veal varies to those of Tuma (1963).

There was no significance found between lamb colour scores and sensory traits. However, the blue colour score of beef was found to significantly effect the overall satisfaction score.

The relationship between pH and meat colour has been well documented (Kidwell, 1952). The results reported may indicate the relationship may be due to the blue value component of the intensity colour score. The blue value also is significantly related to the pH level.

Significant differences were found between beef suppliers for taste, tenderness, overall satisfaction and pH levels. These variations demonstrate the importance of developing partnership agreements with suppliers that increase communication and feedback of results to enable continuous improvement to occur.

4.7 CONCLUSION

The best practice processes developed by the Q.F.C.L. meat enhancement program have shown improvements in customer satisfaction, closer relations with suppliers, the use of the latest technical equipment and language, accurate specifications, a team building approach that has lead to individuals taking responsibility for improvements in identified performance indicators and the ongoing development of continuous improvement procedures.

The Q.F.C.L. meat enhancement program achieved real gains by lowering customer complaints, improving beef and lamb sensory scores, lowering variation in product lines supplied to each catering centre, development of the most appropriate cuts of beef or lamb, improving efficiency and wastage rates and achieving price competitive purchasing results. All of these enhancements enable marketing advantages over competitors and higher customer satisfaction levels.

The identification of the variation of delivered degree of doneness of beef and lamb is a major problem facing these industries if market share is to be gained in the catering industry around the world.

The effect of pH on palatability traits and degree of doneness under commercial conditions needs further investigation. Further studies on the percentage of high pH beef and lamb supplied to the food service industry needs to be carried out.

In summary the strength of the meat enhancement program was a balance of:

* The general manager's strong level of commitment and vision of the future customers requirements - "leadership";

* identifying and giving respo nsibility to people who could make change - "change agents";

* implementation of a manage nent structure and process "best practice";

* the technical training, de velopment of skills, accurate specifications and implementation of quality as surance programs;

* the identification of a few key suppliers who against major industry pressure believed and committed their busines es to supplying the right product to Q.F.C.L.

4.8 APPENDIX 1: INPUT CODES

Product

1: 50g-60g fillet steak
2: 90-100g fillet steak
3: 120g fillet steak
4: 150g fillet steak
5: 700g-900g fillet steak
6: Tenderloin
7: Tenderloin Pieces
8: Striploin
9: Striploin (netted)
10: Knuckle
20: Lamb Rack
21: Lamb Noisette
22: Lamb Cutlet
23: Lamb Backstrap
24: Lamb Leg & Netted
25: Lamb Loin & Rolled
26: Lamb Leg Medallions
27: Lamb Fillets
28: Lamb Noisette Roll
29: Lamb Outside
30: Lamb Tenderloin
31: Lamb Silverside

Taste Panel Scores

1: Very Poor
2: Poor
3: Average
4: Good
5: Very Good
6: Excellent

4.8 APPENDIX 2: TYPICAL MEAT SPECIFICATIONS

SPECIES	:	BEEF
PRODUCT IDENTIFICATION NAME	:	STRIPLOIN
AUSMEAT TECHNICAL MANUAL NUMBER	:	2140 (3 RIBS)
ACCEPTABLE CARCASE WEIGHT CLASS	:	22 -32 (200KG TO 320KG)
ACCEPTABLE AUSMEAT CATEGORIES	:	YEARLING (Y), YEARLING STEER (YS), YOUNG (YG), YOUNG STEER (YGS)
ACCEPTABLE N.S.W. MEAT INDUSTRY AUTHORITY GRADE	:	N.S.W. PREMIUM PURPLE

ACCEPTABLE AUSMEAT CHILLER ASSESSMENT STANDARDS (DERIVED FROM)

MEAT COLOUR	:	1 TO 3
FAT COLOUR	:	0 TO 2
MARBLING SCORE	:	2 TO 4
FIRMNESS AND TEXTURE	:	3 (VERY IMPORTANT)

MAXIMUM pH VALUE : 5.7

GENERAL: Lot/grain fed quality only. Trimmed of subcutaneous fat to a max. of 10mm and min. of 8mm over the back of striploin. Care to be taken during boning to avoid deep cuts. Tail to be trimmed to 0mm from the eye of the striploin. Multifidus Dorsi removed. Take off gluteus medius end of striploin and leave 3 ribs on.

Only minimum amount of roller brand to be retained. IW/VAC Packed with a min. age of 14 days and max. age of 28 days at a temperature of 0 C. Minimum loin eye area of 65 sq. cm Beef must come from animals electrically stimulated at slaughter.

Bags not to be perforated. Cryovac fresh product to be trimmed on day of delivery.

Note: Suppliers name, date of processing and original cryovac date to be placed on each new cryovac package.

Chapter 5: INFLUENCE OF PH ON MYOGLOBIN DENATURATION (DEGREE OF DONENESS) IN SET COOKED BEEF FILLET STEAKS.

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5.1 SUMMARY

As part of a program to validate product specifications for purchasing beef by Qantas Flight Catering Ltd, an experiment was undertaken to examine the effect of pH on the cooked

degree of doneness, when steaks were prepared using a time constant cooking process. A total of 66, 120 g centre cut fillet steaks (M. poas major), evenly distributed over the pH range of 5.4 to 6.4, were sourced from carcasses which had 2 permanent incisors erupted. pH, marbling and steak dimensions (weight, diameter and thickness) were measured. The steaks were frozen and later thawed prior to undergoing the first cook in an automatic griller, chilled overnight and the final cook in a convection oven at 180°C for 13 minutes. Degree of doneness was subjectively assessed and internal steak colour and temperature measured. There were significant effects for pH, steak thickness, cooked temperature ($P<0.01$) and steak weight ($P<0.05$) on the subjective assessment of cooked degree of doneness. An increase in 1.0 unit of pH resulted in a decrease of 1.8 doneness scores (assessed on a scale 1=rare to 5=well done).

The results demonstrate the importance of limiting pH ranges and steak dimensions as a means of controlling the acceptability of doneness of beef fillets prepared using automatic cooking processes.

5.2 INTRODUCTION

The food services industry is placing increasing emphasis on the consistency and quality of its cooked products, which is reflected in tighter purchasing specifications being implemented across a range of food products. Often the variation in beef quality traits such as tenderness, flavour, size, shape and doneness of the cooked product are unacceptably high and a source of customer complaint. There is a need to develop product specification systems which will minimise variation in these meat traits.

Doneness of a cooked steak is one of the first quality attributes a consumer will assess on a cooked meat dish.

Apart from temperature and cooking time, Trout (1989) showed that pH was an important factor controlling denaturation of the myoglobin and therefore, degree of doneness. These results were obtained using ground meat samples and it is important to establish the effect of pH using portion control cut steak, which comprise a large portion of the steaks used by the catering industry. As part of a program to validate product specifications for purchasing beef by Qantas Flight Catering Ltd, this experiment was undertaken to examine the effect of pH on the cooked degree of doneness in portion cut steaks cooked using a time constant, part cook/chill/reheat cooking process.

5.3 MATERIALS AND METHODS

Sixty six, 120 - 130 g beef tenderloin steaks (M. psoas major) were sourced from carcasses which had been electrically stimulated and had 2 permanent incisors erupted. Tenderloins were removed from the carcass, vacuum packed and stored at 2-5°C for 10 days prior to sampling for this experiment. Steaks were selected to give an even distribution of pH over the range 5.4 to 6.4 which was measured using a Jenco microcomputer pH meter model 6007 and a Ionode meat probe IJ42.

One centre cut fillet steak was cut from a full tenderloin, and its fresh weight, pH and steak dimensions (thickness and diameter) recorded. A digital image was analysed for marbling percentage (the number of white pixels as a percentage of surface area). The steaks were then placed on a polystyrene tray, vacuum packaged and frozen at -15°C for 28 days. The steaks were thawed in a chiller at 2°C for 36 hours, prior to weighing and undergoing the first cook.

The first cook was done using an automatic gas conveyor griller with a cooking time of 2.43 minutes. After the first

cook all steaks were placed in a commercial chiller (0-2°C) for 18 hours. The following day each steak was placed in an alfoil cooking dish with vegetables and then covered with alfoil to replicate a typical economy class airline meal. The final cook was completed using two airline convection ovens set at 180°C for 13 minutes. The position of the trays during cooking was recorded.

After cooking, steaks were removed from the trays, weighed and cut along the longest axis. One half of the steak was cut into four cubes and subjectively assessed by a trained panel of four chefs for degree of doneness (1 = rare to 5 = well done) and eating quality (juiciness, flavour and tenderness on a 6 point scale where 1 = very poor and 6 = excellent). The chefs regularly assessed the eating quality traits of tenderloin steaks over the full range of the scale. The other half of the steak was cooled at room temperature for a minimum of 20 minutes and colour of the cut surface assessed using the CIE-L*,a*,b* space (Warner, 1989) measured by the Minolta Chroma meter (CR-310). The Minolta readings were a mean of at least three measurements along the length of the cut surface.

Thaw loss percentage was calculated as fresh weight minus the thawed weight prior to the first cooking, expressed as a percentage of fresh weight, whilst cooking loss was calculated as thawed weight minus final cooked weight, expressed as a percentage of thawed weight.

Using univariate analyses, the effects of pH, steak weight, thickness and diameter, marbling percentage and cooked internal temperature (as both linear and curvilinear terms) on doneness and percentage thaw and cooking losses were examined. Non-significant ($P>0.05$) terms were sequentially deleted from the model until the simplest significant model was obtained.

Due to high correlations within the taste panel assessments of eating quality (juiciness, flavour, and tenderness) and within the three dimensions of the colour space (L*a*b*), these characteristics were analysed as multivariate traits using the same initial model and model reduction procedure to the univariate analyses. When the final multivariate models were obtained, a canonical variate analysis was used to assess the significance of the independent variables on the components of the multivariate traits (ie. eating quality and colour space).

5.4 RESULTS

Means, standard deviations and ranges for variables from both the fresh and cooked steaks are shown in Table 5.1. The steaks were cut to comply with rigorous catering specifications, and there was little variation in fresh steak weight (coefficient of variation of 2.5%). However, there was considerably more variation in steak thickness and diameter. Although the average doneness of the steaks was just over a score 3 (ie medium), the scores ranged from 1 (ie rare) to 5 (ie well done). Cooked internal temperature of the steak also varied widely with a range of almost 30°C.

When adjusted to the same cooked temperature, doneness scores were significantly affected by pH ($P<0.001$), thickness ($P<0.01$) and fresh weight ($P<0.05$) (Table 5.2). A 1.0 unit increase in pH resulted in a 1.8 unit decrease in doneness score as shown in Graph 5.1. A 10 mm increase in thickness resulted in a 0.5 unit decrease in doneness, whilst a 10 g increase in weight resulted in a 0.6 unit increase in doneness. Higher cooked temperature (due to differences in position of the ovens) also resulted in an increase in doneness score.

For the multivariate analysis of eating quality, both pH and

cooked temperature were significant ($P<0.05$). The canonical vector for pH indicated that the major effect was on the flavour and tenderness dimensions, with relatively little effect on juiciness (the standardised elements of the canonical vectors were 1.18, 0.92, and 0.53, respectively). The canonical vector for cooked temperature indicated that the major effect was on the tenderness and juiciness dimensions and to a lesser extent flavour (the standardised elements of the canonical vector were 0.75, 0.61, and -0.43, respectively).

pH had a significant effect ($P<0.01$) on both percentage thaw and cooking loss, with an increase of 1.0 unit in pH resulting in 8 and 6 percentage units decrease in thaw and cooking loss, respectively (Table 3). A 10°C increase in cooking temperature resulted in 4 percentage units increase in cooking loss. The multivariate model for colour, showed that pH had a significant ($P<0.05$). The standardised elements of the canonical vector for pH were 1.04, 0.03 and -0.20 for the L*, a* and b* dimensions respectively, indicating the major effect of pH was through the lightness (L*) colour dimension. The standardised elements of the canonical vector for cooked temperature were -0.03, 1.27 and -0.83 for the L*, a* and b* dimensions respectively, which indicated that the effect of cooked temperature on colour was largely through the a*, and to a lesser extent the b* colour dimensions, with relatively little influence on the L* colour dimension. The regression coefficients for the effects of both pH and cooked temperature on the colour dimensions are shown in Table 5.3.

5.5 DISCUSSION

When steaks were cooked under a set-timed two-stage cooking regime those steaks with high pH resulted in a lower doneness score and a darker colour (ie a lower L* value). Trout (1989) showed that when cooked to 65°C, beef mince with a pH of 5.5 had almost a three-fold increase in the percentage of

myoglobin denaturation compared with mince with a pH of 7.0. As cooking temperature increased the extent of myoglobin denaturation increased at all pH levels, so that at temperatures of 75°C or above, pH had little effect on myoglobin denaturation of beef muscle. Similarly Oreshkin and Borisova (1988) reported that denaturation loosening of the myofibril proteins occurred at a lower temperature in low pH beef.

Steaks at the front of the oven had a lower cooked temperature, which was reflected in the lower doneness score. Surprisingly steak thickness had a significant effect on doneness, after adjustment for cooked temperature. The effect of cooked temperature on the dimensions of the L*a*b* colour system agreed with Lyon, Greene and Davis (1986) who found that differences in temperature were most strongly reflected in an a decrease in the redness (a*) and yellowness (b*) dimensions.

The effects of pH on percentage thaw and cooking loss have been well documented (Lawrie, 1985). At low pH levels these losses can be of the order of 30 to 40% of the initial weight of the fresh product and represent a substantial loss to the catering industry.

The relationship between pH and eating quality of beef is complex. Most studies show an improvement in tenderness of very high pH meat (eg. Bouton et al., 1957), although the effect of low pH is more variable. A number of studies have found a curvilinear relationship with a maximum toughness at a pH of 6 (Bouton et al., 1973), but these reports are confined to muscles that are able to shorten pre-rigor in the carcass (Eikelenboom, 1993). Other studies have shown a linear relationship between pH and tenderness (Dransfield, 1981). A number of mechanisms have been proposed to explain more tender meat at higher pH, including increased water holding capacity, enhanced protease activity and reduced

cooking loss. However, Marsh (1993) considered that the effect may simply occur via the effect of pH on doneness. Based on the results from Trout (1989) he proposed that the lower degree of myoglobin denaturation in high pH meat would result in more tender meat. After adjustment for cooked temperature, the multivariate analysis of eating quality in this study showed a significant effect of pH, largely via the flavour and tenderness dimensions. Flavour decreased as pH increased which is consistent with results from Bouton et al. (1957). However over the range of pH sampled in this study there was a linear trend for tenderness to increase with increasing pH given the same cooked temperature. High pH steaks will be less done at the same cooked temperature and will require further cooking to attain the desired degree of doneness. This further cooking will increase protein hardening and loss of juiciness.

5.6 CONCLUSION

Ultimate pH accounted for a significant proportion of the variation in doneness of steaks prepared under automated cooking procedures. This relationship was independent of cooked temperature. Food industries that require restricted variation in doneness should source product within a narrow pH range. Even when steaks are sourced within a 10 g weight range, both the weight and steak thickness caused variation in doneness. Low pH steaks were scored as having a better flavour but were less tender at the same cooked temperature. The contrasting relationships between cooked temperature and pH on degree of doneness may explain some of the variation in the scientific literature between ultimate pH and tenderness. Low pH steaks also had higher losses both during the thawing and cooking processes.

Table 5.1: Means, standard deviation and the ranges for variables from the fresh and cooked fillet steaks

Variables	Mean	Standard Deviation	Range	
			Minimum	Maximum
Fresh				
Freshweight (g)	126.0	3.16	120	130
Thickness (mm)	38.7	5.75	30	50
Diameter (mm)	58.8	5.13	48	73
pH	5.7	0.22	5.44	6.37
Marbling %	1.3	0.88	0	3.8
Thaw loss %	7.1	5.20	-2.36	26.26
Cooked				
Doneness (1-6)	3.0	1.21	1	5
Cooked Temperature (°C)	63.4	6.67	49	78
Taste Panel Scores				
Tenderness (1-6)	3.2	0.89	1.75	6.0
Taste (1-6)	3.3	0.87	1.0	5.75
Juiciness (1-6)	3.5	0.80	2.0	5.0
Cooking Loss%	21.9	3.81	14.16	32.23
Colour dimensions				
L*	46.6	3.53	39.93	56.08
a*	20.3	4.30	9.38	29.82
b*	10.3	1.18	7.41	12.89

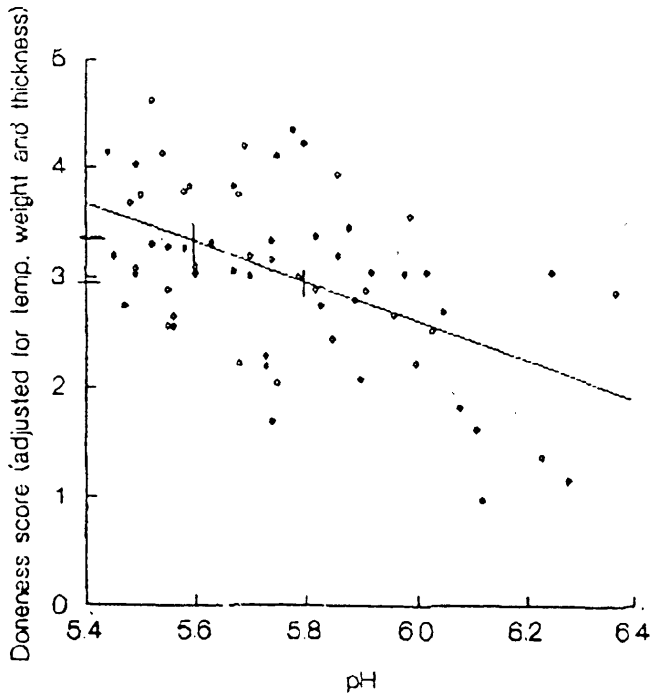
Table 5.2: Regression coefficients (±SE) and coefficients of determination (R^2) for the effects of pH, fresh steak weight, thickness, and cooked temperature on degree of doneness and eating quality.

Independent Variables	Dependent Variables			
	Doneness	Eating quality		
		Tenderness	Juiciness	Flavour
Constant	-0.9 (3.99)	0.85 (2.77)	2.20 (2.51)	6.40 (2.82)
pH	-1.7 (0.38)	0.75 (0.47)	0.52 (0.43)	-0.37 (0.48)
Fresh wt	0.0 (0.02)	-	-	-
Thickness	-0.0 (0.0)	-	-	-
Cooked Temperature	0.1 (0.0)	-0.03 (0.01)	-0.03 (0.01)	-0.01 (0.01)
R^2	0.70	0.12	0.10	0.04

Table 5.3: Regression coefficients (±SE) and coefficients of determination (R^2) for the effects of pH, and cooked internal temperature on thaw loss %, cooked loss % and colour dimensions (L*a*b*).

Independent Variables	Dependent Variables				
	Thaw loss %	Cooking loss %	Colour dimensions		
			L*	a*	b*
Constant	53.76 (12.69)	34.03 (7.77)	66.66 (9.85)	19.62 (12.26)	10.68 (4.01)
pH	-8.21 (2.20)	-6.60 (1.28)	-6.05 (1.62)	3.81 (2.02)	-0.16 (0.66)
Cooked Temp	-	0.4 (0.04)	0.23 (0.05)	-0.33 (0.07)	-0.01 (0.01)
R^2	0.18	0.64	0.33	0.30	0.04

GRAPH 5.1 Relationship between pH and Degree of Doneness



Influence on pH on Myoglobin Denaturation (Degree of Doneness) in set cooked beef fillet steaks.

(Cox, R.J., J.M. Thompson, P. Elwin, M Predeth and D.P. Casey)

Doneness scores were adjusted to a mean weight, thickness and cooked temperature.