QUALITY IDENTIFICATION AND CONTROL

John C. Ayres

Introduction

The word "quality" is derived from the Latin, qualis or qualitas, meaning "how constituted" and generally refers to peculiar excellence to distinctive character, trait, power, capacity or virtue. It can also refer to class, kind or type. Many different terms are used to identify or characterize product quality. When used in a broad sense, quality might involve all attributes that influence the consumer's demand for the product. More practically, the consumer takes into consideration a number of the product's characteristics and, after determining these several desirable and undesirable features, evaluates overall performance in comparison with a real or imaginary model or standard.

The criteria used in the identification of quality vary with the commodity, utility or service provided. For example, a set of attributes considered useful in measuring the value of a textile might be useless in determining the edibility of a foodstuff or the workmanship or preparation of a piece of machinery. In order to delimit this enormously complex subject to some extent, the following remarks will be confined to foods. Even within this restricted framework, the identification of quality is no easy undertaking.

Food quality has been identified as the product of the characteristics of a given item which influence its acceptability, preference and value to the consumer. One food technologist, Dr. Pauline Paul, identified food quality as a composite of (1) what the housewife sees in the store, (2) what she has to do with it when she gets it home, and (3) what happens when she serves it. Since these three considerations change in importance from day to day, from person to person, and from commodity to commodity, the identification of quality likewise varies.

Universally accepted standards exist for very few products and, consequently, judgment of quality varies with the evaluator's point of view. Recently, Dr. S. R. Hoover1, in writing on the subject "Quality in Animal Products" concluded "There are three quality factors that the consumer looks for in fresh and processed foods. They are color, flavor, and texture." Dr. Hoover over-looked or failed to mention such considerations as convenience, uniformity, size and shape, absence of defects, body, performance, and utility, keeping quality or stability, wholesomeness, nutritive value, and economy. All of these attributes require consideration since any one of them may cause an otherwise satisfactory commodity to be considered unacceptable. For example, a product may be priced economically, have an

John C. Ayres is professor of Dairy & Food Industry, Iowa State University.

attractive appearance, be wholesome and nutritious, but not have acceptable palatability. Such a product will be rejected. In addition, psychological considerations such as prestige, self-esteem, and approval of others and basic drives to overcome hunger and to provide necessary health, safety, comfort and beauty must also be considered.

Factors Used in Determining Quality

The relative weight that consumers assign to the various factors that comprise quality makes it difficult, if not impossible, to intelligently predict responses. A few words about each of the more readily recognized attributes will illustrate the complexity of the quality problem.

Convenience. Perhaps convenience is not in reality a quality factor but merely an attribute of the product that the consumer takes into consideration and substitutes for other desired characteristics. In whatever manner it is considered, convenience is becoming an increasingly important consideration and, depending upon the preferences and needs that apply to a particular situation, is an important determinant of acceptance.

The drastic change that has taken place within the past 15 years in the marketing of citrus juices is a graphic illustration of the influence that convenience exerts on demand. Notwithstanding this impact, the continued use of large numbers of whole oranges, lemons and grapefruit still bear witness to the fact that other quality factors require consideration.

The word convenience is becoming greatly overworked and misused. Several food preparations that are convenient to use for certain purposes do not have the same value for other applications. A few months ago "TV dinners" enjoyed a popularity that they do not now hold. While these meals were largely in prepared form and eliminated the need for purchasing a number of items separately, their palatability and cost characteristics were not completely satisfactory for many consumers; further, since the product required 35-45 minutes warm-up in the oven, it had no advantage over meals prepared in a more conventional manner when the consumer had no interest in spending the interim watching a television program.

Uniformity. The food processor will compromise or even sacrifice other quality attributes in order to attain a product with uniform characteristics. The food canner may not strive for the best possible product unless he has some assurance that he can maintain the same level of excellence throughout the season. Early during the growing period he may delay harvesting of peas or corn or may purposely add starch to the brine when these vegetables contain large quantities of sugar; later, when the peas or corn or more starchy and mature, the procedure is reversed so as to maintain duplicability of the product throughout the year. Uniformity characteristics
of prime importance vary considerably among commodities. Essential considerations of uniformity for tomatoes include size, firmness, acidity, maturity or ripeness, and color; for cucumbers, shape, length, absence of seeds, crispness, and color; for asparagus, compactness and straightness of stalks, and succulence; for eggs, size and shape, color of shell, and later of the broken-out egg, height and color of the yolk and albumen; for bakery products, airy texture with many regularly shaped, thin-walled gas cells, brownness and flakiness of crusts, and velvetiness of crumb.

Size and shape. Size and shape are important determinants of quality of commodities that are sold by number or by weight per container such as eggs, oysters, nuts, fruits and vegetables. For products such as citrus fruits and eggs, the larger the size, the higher the total food value. The size and shape of other commodities such as peaches, apples, potatoes, carrots, celery and the like determine the amount of wastage per unit when the products are peeled, sliced, diced or shredded. Large well-shaped prunes, olives, grapes, figs and dried fruits are preferred for aesthetic reasons and therefore sell at a premium. On the other hand, the smallest, most regularly shaped cucumbers are preferred for pickling.

Color. There is an old saying that "we eat with our eyes as well as with our mouths." Color is an important determinant of quality for a number of reasons. In fruits and vegetables it is an index of maturity; in meats it foretells freshness. In dairy products, color has been associated with butter-fat content while in noodles and baked products, color provides a clue as to the presence of desired ingredients such as egg content. Artificial coloring is added to citrus crops to develop the characteristic color of the ripe fruit and in frozen green vegetables to provide an attractive appearance of the product.

Safeguards are taken to prevent loss of color in cured meats due to exposure to air or light or to bleaching of dried or canned fruits and vegetables as a result of the action of sulfur dioxide or chlorine. Similarly, the concentration of salts and the elimination or removal of trace amounts of metals are carefully regulated to prevent discoloration of food products (e.g. pickels).

Texture and body. Texture and body in food products refers to their structural make-up, variations of which have a great deal to do with acceptability of a number of foods. Consumer preferences for certain textural characteristics have led to descriptive adjectives such as "mealy" potatoes, "crisp" celery, "creamy" candy, "fluffy or fine-grained" cakes, "thick" cream, "flaky" pie crust. Determinations of characteristics such as spreading or pouring quality, viscosity, emulsifying ability, homogeneity, brittleness, toughness, etc. are of considerable importance for various food substances.
Flavor. Most foods have characteristic flavors that must be maintained. Accurate control of product ingredients contributing to flavor and aroma is essential if the food is to have desired palatability. Flavor and aroma are enhanced by roasting, fermentation, extraction, etc. Examples are coffee, sauerkraut and vanilla. Commodities such as fish, bakery products and fruit often give off odors that are objectionable. Products such as cocoa, coffee and spices lose their flavors on storage; others such as butter and bacon adsorb foreign odors. Unless handled properly, bacon and butter quickly become rancid.

Absence of defects. Defects generally refer to physiological or pathological imperfections in the foods or to faulty workmanship. Standards usually are established for the specific defect that is likely to be present in an objectionable proportion. These standards may be referred to as tolerances. In apple sauce, they refer to presence of bits of skin, core and seeds, mushiness, and wateriness; in canned peas, to presence of insect injuries or insects, to leaf- or stem-tissue and to broken, spotted or otherwise discolored seeds; in potatoes, to scabiness, irregular contour, discoloration, hollow hearts and sprouting; in eggs, to mottled shells or yolks, blood or meat spots, watery albumen, low yolk height, and green rot.

Performance and utility. Performance or utility of the product is a consideration of great importance for dried eggs; the injury sustained by the mucin due to shearing and to the action of heat prevents the product from reconstituting properly and, when used in cake formulations, results in flat, heavy products. Similarly, evaluation of the functional properties of popcorn, flour, dried milk, yeast, etc. is prerequisite to the acceptance of these commodities.

Keeping quality. In addition to satisfactory performance tests when used immediately, the product must retain desired quality until such time as the consumer would normally expect to use the product in the home. The expected shelf life for perishable commodities such as meat, milk, bread, bananas, lettuce, etc. contrasts sharply with that of dry staples such as sugar, flour, salt and corn meal. Keeping qualities of the latter foods are considered unsatisfactory if these products fail to function properly or become infested with insects shortly after purchase.

Wholesomeness. Wholesomeness includes such important considerations as freshness, cleanliness, purity and safety. Evaluation of freshness and cleanliness must be satisfying to the consumer at the time she selects many commodities such as fruits, vegetables, eggs, dairy products, meats and the like, or these products will be rejected without further attention. Purity and safety are not so readily determined but are essential determinants of quality. Various state and federal agencies maintain policing action to assure the consumer of receiving wholesome foods.
Nutritive value. Any consideration of a food product must include its ability to provide the necessary proteins, carbohydrates, lipids, minerals and vitamins that provide nourishment. While these constituents of the diet are essential, it must be recognized that most consumers give inadequate attention to the nutritional value and that, at best, the nutritive properties of foods can be appreciated only after the product has been utilized.

Economy. The cost of the product, to some extent, is determined in the light of its possession of the other characteristics named above and the values that the consumer places on these in the light of his wants or desires. Many attempts have been made to gain understanding of the relation of the price of the commodity in terms of its value to the consumer. In order to gain a better understanding of this relationship, two general types of survey are used: the market survey and the consumer survey. Market surveys do not present as complex a problem in the collection of data as do consumer surveys.

**Limitations of Surveys in Determining Demand for Quality**

**Market survey.** The market survey provides a quantitative measure of market preference, i.e. a picture of consumer choices in terms of price and the quantities and qualities purchased. Such choices may reflect preferences only roughly, i.e. establish an over-simplified relation between price and consumer preferences. Selections are not solely a function of price and quality of a particular product. Arrangement of foods in the store, proximity of the store to home, access to parking, store services, purchase incentives (e.g. trading stamps), credit privileges, volume of other goods purchased, types of display, and store personnel are a few other factors that require consideration. Also, the range of products and accuracy of labelling may limit the extent of choice. Morse\(^2\) states that, at best, the information secured pertains to past actions of consumers in the market and is applicable in the future only if allowances are made for changes in consumer preferences and changes in supply. A further limitation of the market survey is the inadequate information it reveals concerning the preferences of consumers. For example, the price-quality relationship may or may not indicate the ordinal relation of the consumer's preferences for various qualities. Some consumers may buy a lower-price quality even though they prefer the quality that is most expensive. Others may be indifferent with respect to qualities and will buy that which is lower in price while still other consumers may buy the lower-price qualities because they prefer them.

**Consumer survey.** The consumer survey circumvents the market and goes directly to the consumer. If well conducted, the information it supplies is restricted only to the extent of the consumer's ability or willingness to express

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preferences. According to Morse\textsuperscript{2} two general types of preference surveys are recognized: (a) those intended to evaluate the status of consumer preferences and (b) those intended to search out and evaluate the influence of forces that have shaped their preferences and which might cause them to change. There are many difficulties encountered with consumer surveys. The cost of consumer surveys is often considerable. Wells\textsuperscript{3} estimated the cost of determining women's textile preferences at $35,000 to $50,000. One inherent weakness of the consumer survey is that it fails to measure the intensity of preference for one quality over another. Even if evaluations of the intensity of preference were sufficient to estimate market actions, such measurements would need to be weighted by the disposable income of the individual in order to secure an estimate of his willingness to pay more for one quality than another. Another criticism Morse\textsuperscript{2} made of this type of survey is that it attempts to secure information from the individual that she does not know or about which she has a nebulous concept she is unable to express.

\textbf{Assessments of Quality}

It has been shown that many factors contribute to the evaluation of food products. Therefore it is essential that satisfactory methods of control be employed. Probably no commodity that man uses is more stringently controlled, inspected, and regulated than is his food. Some years ago the federal government introduced grade standards for many fresh and processed foods to insure the buyer of uniform quality and to provide specifications that safeguard against the sale of unfit products.

\textbf{Grading.} The grading service provided by the United States Department of Agriculture is optional and, depending upon the agency requesting the service, may be charged to the seller, the processor or the buyer. Within certain limits, federal grades are intended to provide assurance to the seller and buyer that the commodity possesses a prescribed level of quality at the time of examination regardless of supply, demand, season, geographical location or shipping distance.

Meats, for example, may be graded in accordance with federal or with packer grades. When government grade standards are used, slaughter


livestock is evaluated on the basis of quality, conformation and finish of the carcass. Appearance is used as the index of quality. Form or shape, muscling and proportion of bone are used to evaluate conformation. Amount, quality, and color of fat within and around the muscle are considered in the judging of finish. For beef, seven U. S. Grades have been designated. These are: Prime, Choice, Good, Standard, Utility, Cutter and Canner. Government grading of meats has been censured as being archaic, arbitrary, and confusing and the specifications used in describing grade standards have been criticized as being subjective and insufficiently descriptive to permit the sorting of carcasses into homogenous groups.

Clifton and Shepherd\textsuperscript{4} suggested the use of an objective grade standard based upon weight, length and loin-eye fat thickness. They point out that other factors such as color, marbling, area of loin-eye muscle, etc. must also be considered before the final grading of the carcass can be made.

Several of the large packers argue that federal grading standards do not reflect consumer wants and that they will be better able to serve the consuming public if not limited by a federal grading system. Many packers prefer to use their own brand names to designate their better quality meats. Often names used in describing these products are chosen carefully so that they are properly flattering; for example, = Premium, Packer's Choice, Star and the like.

Standards used by packers are not uniform. In addition, some of the grade designations are needlessly complimentary. The terms "select" and "top select" are preferred by the industry to "standard" and "upper-" or "high-standard" for describing U. S. Standard carcasses. When one considers that "select" carcasses are inferior to the grades Good, Choice and Prime and that, in fact, a "select" carcass may be at the lower limit of the Standard grade, the layman's connotation of its desirability may differ considerably from that of the packer.

None of the methods of grading developed to date accurately foretell several of the factors that the housewife considers of greatest importance; namely, price, uniformity, color, tenderness, juiciness, and palatability. In other words they do not predict eating quality.

One of the greatest obstacles that must be surmounted in arriving at acceptable quality standards is the tendency of special interest groups to consider the desirability of the commodity in the light of their own wants and desires rather than from the point of view of the ultimate user. This sort of fallacious

reasoning often has been responsible for confusions and contradictions that arise later. An illustration in point is the recent decision of the United States Department of Agriculture to abandon grading of lamb and a few weeks later a retraction of this decision. The meeting leading to the mandate that lamb would not be graded beginning Jan. 1, 1960, resulted from deliberations of two factions—one opinion being represented by the wool producers, large meat packing firms and the American Meat Institute and the other by the small packers, chain stores, major farm organizations, and the Federal Grading Service. It should be pointed out that although the Federal Government had originally introduced grading "to provide consumers with a reliable guide to quality," no consumer groups were invited to participate in the discussion that led to the decision to abandon grading. A few weeks later when it became apparent to the Secretary of Agriculture that many important considerations had been handled in a rather cursory manner, the decision to abandon grading was reversed.

Current Attitudes Regarding Quality

At present, the viewpoint is taken that an imperfect measurement of quality, even though not entirely satisfactory, is better than none at all and that until more satisfactory methods of determining quality are devised, the elimination of grading serves little real purpose. The training and experience of men who are without a vested interest does provide a valuable service to the consumer. What is still needed, however, is a rating system that is simple, easily understood, practical and duplicable, and that will establish grade standards capable of separating carcasses into definite increments which will foretell the level of quality that the consumer wants.

Recently (Feb. 9, 1960) an editorial in the Des Moines Register indicated that "There has been a considerable shift in consumer preference for leaner pork in recent years = but so far (the packing) industry has made little progress in satisfying this preference despite valiant efforts by swine producing organizations and some packers to emphasize meat-type hogs."

That American hog raisers and meat processors are paying insufficient attention to the importance of leaner, meatier hogs is witnessed by an annual importation of canned hams equivalent to the production of from 5 to 6 million hogs. Since these imported canned hams sell at a premium, it is evident that their excellent shape, size, leanness and slicing characteristics are in demand. As yet, agreement on methods of identifying these essential quality factors in carcass meats have not been developed nor have ways been found to establish the relationship of the original carcass characteristics to its final acceptability. Apparently some of the difficulty in satisfying consumer wants arises from the fact that the grower does not have proper incentive for producing types and kinds of hogs that consumers prefer. To some extent there is insufficient information regarding the kind of animal that is in demand and at the same time provides maximum return to the farmer.
Apparently the application of certain chemical agents such as the sulfonamides, diethyl stilbestrol, papain, ascorbic acid, and the antibiotics not only are reducing the incidence of disease in the livestock but are profoundly influencing methods of feeding animals, of making carcasses tender and attractive, and of enhancing color, palatability and storage life of meats. However, while providing these valuable services, specialists have not enjoyed equal success in making their knowledge understandable to the public and the use of "chemicals" is viewed with considerable suspicion. This common circumstance was ably outlined in a statement made by Richard S. Aszling before the Inter-Industry Conference on Chemicals in Foods sponsored by the Manufacturing Chemists' Association in New York, Jan. 15, 1952, which is quoted in part:

"Communicating successfully with large groups of people is not an easy thing to do... The job in communicating with the public is first and foremost one of semantics— that is, the translation of professional language into word-symbols that will get through to the public mind. The very work chemical itself is a handicap because it has adverse overtones. To many laymen, a chemical is something that smells bad, explodes, or poisons, and you can't blame them for not wanting one in their food. If you tell an average businessman that his wife added monosodium glutamate to his vegetable soup, he would probably suspect her of trying to collect his insurance. But you call the same substance "Accent," put it up in handsome packages, and advertise it with sophisticated copy in the New Yorker magazine, the same man will insist that his wife use it."