TECHNICAL REPORT
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DEVELOPMENT OF OBJECTIVE END PRODUCT TESTS FOR PIECE SIZE IN COMBINATION FOOD PRODUCTS.

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FOOD LABORATORY
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FOREWORD

The Navy requested in FY-70 that a number of precooked frozen entre foods be developed for use on shipboard and procurement documents written to be production tested in FY-71. In the course of the development it was found desirable to consider end product tests to ascertain the weight of meat pieces in the final products.

This study was undertaken to develop a general test which could be adapted for use with many products and which could be used as a specification requirement.

The work was performed under 1J6-64713-D548, Combat Feeding Systems, Response to DoD Requirements.

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ABSTRACT

Various sieving methods for determination of weight of poultry pieces in five combination poultry foods were examined. It was found that a wet sieving method in which the sieve containing the product is dipped in a large container of water several times gave the most consistent results with all products. It is concluded that this method can be adopted for use in specifications of many combination foods as an end product test.

Introduction

The trend in food specifications is toward end product requirements to replace process requirements. Most important food quality parameters such as flavor and odor are subjective and it is very difficult to establish meaningful end product requirements which can be accepted as binding by both procurement and producer. Texture also is considered subjective, but certain aspects affecting texture such as the piece size of diced ingredients in combination foods and piece integrity such as whole versus crushed or broken peas should be measurable in objective terms. Usually a broad range of meat dice sizes will be acceptable to a consumer taste panel even though individual panel members may differ from the panel average preferment in either direction.

From the manufacturer's standpoint it is usually cheaper to have no control on meat piece size. This not only allows "sloppy" manufacturing procedures, but permits the use of scrap or reworked materials. Often when price is the only objective, this results in an end product which has no or very few discernible dice or pieces and is an undistinguishable "mush" which very quickly leads to consumer dissatisfaction. The appearance, texture, and mouthfeel of the product are too different from the familiar or expected even though the flavor may be excellent.

In most cases, the cost of a combination food item is directly proportional to the cost of the meat in it. The quantity of meat within the limits of the given product identity is considered a quality factor. The combination of this factor along with the piece or dice size makes meat one of the most important parameters to be measured in end product tests.

Most of the present specifications stipulate process requirements which control processing and dicing so that discernible pieces of meat are present in the final product. This is true of freeze dried chicken stew and chicken with rice both of which are in the Food Packet, Long Range Patrol. Specifications are being developed for new frozen entre items and it is deemed essential that some sort of meat piece size control be used. Since the frozen entre items and the freeze dried items are physically very similar when prepared for serving, end item tests can be developed which are independent of the original preparation process.

While control of processing and dicing will control piece size to a certain extent, handling of the product, excessive mixing, and careless packaging can cause excessive breakage. Therefore, an end item test is a more logical approach to obtaining a satisfactory product as well as alleviating inspection problems.

This study was undertaken to develop a general test or technique by which end product piece size can be determined and which can be used with

minor modifications for several different products. General criteria for the test were simplicity, reproducibility and accuracy.

Experimental

Three frozen entre items intended for distribution in 5-lb. aluminum pans were studied. These were chicken ala king (1), chicken cacciatore (2), and turkey and gravy (3). In addition two freeze dried main component items, chicken stew and chicken with rice were studied. All of the items were made at NLABS in accordance with the purchase descriptions for the frozen items and for Food Packet, Long Range Patrol (LRP) (4).

The chicken used in the products was cooked in steam to an internal temperature of 170°F. and then boned. The boned chicken was chilled to about 40°F. and diced or cut by hand. Hand dicing will not produce the same variation in piece size as will machine dicing with cooked chicken. However, this was not deemed important as far as development of test procedures is concerned, but would be important for specification requirements. The chicken used for chicken cacciatore was cut into pieces varying in size from small up to quartered breast meat pieces.

The turkey in turkey with gravy, frozen, is sliced. However, the product is usually made from prepared turkey rolls so that the slices are composed of smaller pieces bonded together with gelatin. If it is prepared from slicing whole cooked birds, there is the possibility of small pieces and scraps being added to make up the total meat weight specified. When the product is handled at room temperature the slices and pieces made from turkey rolls are held together by gelatin. Therefore, it is necessary to heat it to at least 100°F. to melt the gelatin in order to obtain a good separation.

Commercial turkey rolls were used for turkey and gravy since specification rolls were not available. The rolls were sliced approximately 1/8 inch thick. It was found that these rolls contained about 20 percent filler (gelatin, etc.) which is more than allowed in the specification rolls, but this was not considered important for development of test procedures. However, specification requirements based on this test would have to reflect the correct raw material.

The formulas for the various products are shown in Table 1. Size of the meat ingredients varied from 1/2 x 1/2 x 1/4 inch dice to large pieces of chicken (breast meat quartered) and slices of turkey.

Table 1

Ingredient	Chicken ala King	Chicken Cacciatore	Chicken and Rice	Chicken Stew	Turkey with Gravy
	%	%	%	%	%
Chicken, cooked					
Diced 1x1x1/2	30.0				
Diced 1/2x1/2x1/4			38.5	29.0	
Pieces		38.0			
Turkey, sliced					31.0
Carrots, diced 3/8x3/8x3/8				5.0	
Mushrooms, diced		5.0			
Peas				4.5	
Pimientos			2.7		
Potatoes, diced				21.0	
Rice, instant			9.6		
Tomatoes, canned		20.0			
Seasoning & Sauce mix	70.0	5.5	7.7	8.5	69.0
Water		30.5	41.5	32.0	

The most logical technique for determining piece size would be by screening. This is a common technique with which the inspection service is familiar and for which equipment is commonly available. It is used in the procurement document for the Food Packet, Long Range Patrol (4) with dry chili con carne to determine the condition of the beans. However, it would not be successful with the chicken component of chicken stew and chicken with rice because the dry chicken is so brittle it would break up during the screening process. When the products are rehydrated the chicken is no longer brittle and will substantially withstand a screening process. The dehydrated items, when rehydrated, and frozen items, when heated, are thick, sticky masses which make clean separation of ingredients extremely difficult. Therefore, it was decided to try screening by a shaking machine such as the Ro-tap,* spraying with water during screening, and dipping the product on screens in an excess of water. Screening the products by hand shaking of the screens was considered but rejected since this method is too difficult to control as an inspection procedure.

*W. S. Tyler & Co.

Results and Discussion

Chicken ala king (frozen)

The 5-pound sample of the product was thawed at ambient temperature overnight and then divided into approximately 3 equal parts. Each part was placed on a U. S. Standard 1/2-inch sieve and washed with a gentle spray of 110°F water until a majority of the gravy material was washed out. The sieve was then placed on a Ro-tap shaker and shaken for 2 minutes. The chicken remaining on the sieve was placed on paper toweling to drain for two minutes, weighed, and results for the 3 portions added together. The results from 6 five pound samples were:

Sample No.	1	2	3	4	5	6
Weight retained (gms.)	343	353	385	351	357	338

The weight range is 47 grams or about 13%.

It was found that the spraying operation was difficult to control and could be a significant variable in the test. However, unless it was done, the product would not separate on the sieve. Instead, it balled up.

In performing the dipping operation, the 5 lb. sample was divided into 4 approximately equal portions. Each portion was placed on a 1/2-inch U. S. Standard sieve and the sieve dipped into a large container of 100°F. water up to about 3/4 of the sieve depth. The sieve was left in the water for 5 seconds and then raised out of the water for two seconds. No attempt was made to agitate the sieve in the water. This procedure was repeated twenty times. The product retained on the sieve was placed on paper toweling to drain and then weighed. The weights of the four portions from each 5-lb. sample were combined. Results from these samples were:

Sample No.	1	2	3
Sample wt. (gms.)	439.0	435.0	441.5

The range is 6.5 gms. or about 1.5 percent.

Chicken Cacciatore

Several preliminary experiments were conducted with this product to determine its characteristics and which size sieve would be appropriate. It was found that the sauce was very adhesive and that spraying followed by use of the Ro-tap would not be successful. Using a 5-second dip with the dipping method did not wash off the sauce very well. However, a 2-second dip apparently agitates the water more and this was successful. Since the pieces of chicken are supposed to be large, a 3.4 inch sieve was used. In the final tests, the chicken cacciatore was handled the same as chicken ala king except for screen size and the use of a 2-second dip time. The results from five samples were:

Sample No.	1	2	3	4	5
Chicken wt. (gms)	657.4	683	657.4	695.6	676.5

The weight range is 38.2 gms. or about 5.5%.

Turkey with gravy (frozen).

This product presented two problems in evaluation. When thawed to room temperature, the turkey slices stuck together and the product could not be easily separated into portions for sieving. This was solved by heating the product to approximately 100°F. The other problem was the slices of turkey matting on the bottom of the sieve preventing the other material from going through. Because of this, normal sieving by hand or on the Ro-tap machine was not practical. However, dipping the sieves would work since the movement of the sieve in the water caused displacement and some agitation of the slices.

The dipping operation was carried out the same as with chicken ala king except that the product was divided into 3 portions and each portion was dipped 10 times. Sieve size was 1/2-inch. The results from 5 samples were:

Sample No.	1	2	3	4	5
Weight retained (gms.)	487.2	487.4	479.1	482.1	483.6

The weight range is 8.3 grams or approximately 1.7 percent.

Chicken and Rice (freeze dried)

The chicken and rice was rehydrated in the ratio of 4 oz. of product to 32 oz. of 100°F. water for 10 minutes. This is slightly more than twice the amount of water used to rehydrate the LRP product. The rehydrated product was emptied into a U. S. Standard 5/16 inch sieve and shaken on the Ro-tap for 2 minutes. This method proved impractical since the product formed into gummy balls and was impossible to separate by sieving.

When the product rehydrated as above was placed on the sieve and then sprayed with water some separation occurred, but it was so variable that it appeared impractical to develop a valid test using spraying. Results on three samples were:

Sample No.	1	2	3
Weight retained (gms.)	47	29.2	45

The appearance of the product as well as these results indicated that the method was not promising so no further samples were tested.

For the dipping operation, the product was rehydrated as above, placed on a 5/16 inch screen and dipped as was done for the chicken ala king. In

this case, however, the product was dipped only 15 times before being drained and weighed. Results on 7 samples were:

Sample No.	1	2	3	4	5	6	7
Weight retained	46.4	43.9	48.2	41.0	40.8	42.4	41.8

Range of weights is 7.2 grams or approximately 17 percent.

Chicken stew (freeze dried)

This product presents problems in sieving since the vegetables are large enough to interfere with complete separation of the chicken. However, testing with various size sieves indicated that U. S. Standard 7/16 inch sieve can give a satisfactory separation. With this size a certain amount of chicken will go through the sieve.

The dehydrated product was rehydrated in the ratio of 4-5/8 ounces of product to 32 ounces of 100°F. water. It was then tested in the same way as was the chicken and rice. As with chicken and rice it was found impractical to use the Ro-tap machine since the product would not go through the sieve. Spraying the product on the sieve was better, but again did not give consistent results.

Procedure used for the dipping operation was the same as used for chicken and rice. Results for 7 samples were as follows:

Sample No.	1	2	3	4	5	6	7
Weight retained (gms.)	30.8	31.2	28.8	28.6	29.1	28.8	33.8

The range is 5.2 grams or approximately 17 percent.

Conclusions

No attempt was made in this study to develop a specific test for the specification of any specific product. Rather, it was intended to develop the broad outlines of a test which then could be specifically tailored for each individual product. The study indicates that a method in which the product on sieves is dipped in water can be adapted to many products.

Hand sieving where a dehydrated product is rehydrated with an excess of water or water is added to a heated frozen item is simple, but does not seem to give reproducible results if it works at all. Furthermore, it is difficult to standardize so that various operators obtain the same results. Spraying the product on the sieve with water gives better results, but again this method is difficult to standardize. Using a shaking machine such as the Ro-tap is very easy to standardize, but cannot be used with most products similar to the products considered in this report which would not screen properly.

The dipping method can be standardized easily, requires no equipment which is not readily available to inspectors in the field, and apparently will give reproducible results. However, the method will have to be adapted and standardized for each product. It cannot be expected that a complete separation of the meat will be obtained since there will be small pieces that will go through the screen. It is actually desirable that there be some small pieces in the product since they improve the overall texture and flavor. Thus, the test requirements would be developed on the weight of larger pieces of meat present in the specification product rather than on the formula weight of meat. It is expected that the dipping method can be simplified over the way it was done in this study by taring the sieve before use, allowing the sieve to drain after the operation, and then weighing. This will be evaluated with individual tests as they are developed for each product.

References

1. LP/P DES 12-70 (27 March 1970), Chicken ala King, Cooked, Frozen.
2. LP/P DES 20-70 (27 April 1970), Chicken Cacciatore, Cooked, Frozen.
3. LP/P DES 22-70 (12 May 1970), Turkey with gravy, cooked, frozen.
4. LP/P DES 8-5-0 (10 February 1970), Food Packet, Long Range Patrol.

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13. ABSTRACT

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