

TOOLS AND TECHNIQUES FOR SUCCESSFULLY GRINDING FISH FOR TUBE FEED FORMULAS

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Abstract

Grinding fish in a blender is very complex because the fish often need to be processed to some degree and there are many choices of blenders. Suggested blenders to use include Waring blenders of various sizes, homogenizers, or smaller, but more affordable, Magic Bullet® or NutriBullet®. Using a meat grinder, chopping, filleting, skinning, and successive blending are all methods of processing the fish or other seafood to break it down for optimal blending. There are advantages and disadvantages for every blender and technique. The ratio of fish to water is also important, as enough water is needed to homogenize the formula and to make the formula fluid enough to easily glide through the various sized feeding tubes. Considerations need to be made for the size of the feeding tube, the amount of formula needed, and how much water needs to be added (generally, 70% fish to 30% water) to achieve the desired consistency and/or caloric value. With practice and properly maintained blenders, creating formulas using seafood products can become easier. Knowing which technique and tool to use is just the first step, but practicing helps to refine the skills needed to successfully grind fish for tube feed formulas.

Introduction

At the Georgia Aquarium, we have a variety of blenders and other tools that we use to process fish or seafood in the event that we need to tube feed an animal. However, larger fish, such as herring, cannot simply be added to a blender with water and come out homogeneous enough to easily pass through feeding tubes. The fish need to be cut, likely skinned, and filleted. Some fish and other seafood need more water than others to reach a proper consistency (e.g. shrimp). There are other considerations when one is preparing a tube formula for smaller fish, such as seahorses or discus. The tubes used are very small (e.g., 3.5 and 5 fr. red rubber catheter tubes) and the formulas need to be fluid enough to easily pass through these tubes. Smaller blenders, such as a homogenizer (VWR model VDI 25 S41, see Figure 1) can be helpful with this, but there are problems associated with them as well. There are a couple of commercial home products the Aquarium uses to successfully create a variety of tube formulas, the Magic Bullet® and the NutriBullet®. We also have a manual meat grinder for grinding whole fish and two large blenders, a Waring commercial blender (2 L capacity, model HGB160, which is similar to the currently available model HGB150) and a Waring Heavy Duty blender (4 L capacity, model CB15) for handling larger batches of gruels (see Figure 2). Over the years we have developed several techniques to deal with the challenges of grinding fish or seafood.

Discussion

The type of fish to be used in the gruel, the ultimate consistency required (e.g. what animal is the formula for/what size tube is being used), and the caloric content are going to be the top considerations when deciding which technique to use in processing the fish. Other factors of importance are amount of gruel, time the gruel will be used, and other ingredients to be added.

We never use less than a total amount of 100 g unless we are making a gruel that will be mixed with the homogenizer. Anything less than 100 g does not typically grind well in the Bullets because the blades cannot grab enough material to mix and chop sufficiently. Our nutritionist sets the ratio of fish to water; this is generally 70% fish to 30% water based on consistency and caloric content. However, there are occasions where more water needs to be added in order to obtain a fluid consistency (but always remember to keep track of how much water is added in order to recalculate the actual ratio). Shrimp tends to require more water than other foods in order to become more fluid.

Most tube feed formulas are made within an hour or two of feeding. Some do require more advanced preparation due to personnel or other time restraints. All tube feed formulas are used within 24 hours. However, there are certain fish and seafood products that tend to solidify faster and would require them to be made as close to feeding time as possible. These include shrimp, and some blister pack fish formulas, such as discus formulas (various brands). Also, if any gel powder is added (such as Mazuri[®] Aquatic Gel Diet), that will also cause the gruel to thicken, so feeding out as soon as possible is preferred.

Some formulas may need to be heated up in a water bath before being fed out. An example of this is milk replacement formula. Sometimes a fish formula, after sitting in a cooler for an extended time, will invariably thicken and will need to be thinned with water.

The following are four techniques for processing fish that will work in different situations, followed by the disadvantages of the Magic and NutriBullets[®] and the Waring blenders.

Chopping into smaller pieces

Some fish can be ground whole (e.g. silversides, *Menidia menidia*). However, for more effective blending, it is best to chop the fish up before attempting to grind. This is best done with fish that are not completely thawed. The NutriBullet[®] can handle this in small batches (100 g to 300 g total gruel). Tilting the NutriBullet[®] or Magic Bullet[®] at a 45° angle can improve the mixing capability.

Skin and fillet

Larger fish will often need to be skinned and filleted before being ground in a blender. Head, tails, and fins also do not grind well and should be removed. The skin and spine will not mix and therefore block up the tube when feeding (see Figures 3-5). Using a strainer to remove these after blending was an ineffective use of time and only lessened the amount of total useable gruel. Using fish that are only slightly thawed makes it easier to simply pull the skin off.

Successive blending

When using the larger Waring blenders, sometimes successive blending is useful to achieve a finely ground gruel. The larger blenders may not be able to homogenize the fish finely enough for some purposes. Therefore, additional time in a smaller blender, such as the Magic Bullet[®], is necessary. The disadvantages to this method are that you lose volume and nutrients when transferring from one blender to the other.

Meat grinder

Another way to break the fish down before grinding is to use a meat grinder. The meat grinder takes the whole fish and breaks it down into a fish paste that a blender can easily process with minimal water. However, fins and parts of the head sometimes do not make it all the way through the grinder, not to mention the rest of the fish that is left in the grinder that cannot be cleaned out easily (without rinsing). This method will be able to use the most of the fish, which may be preferable if sample analyses are done using whole fish.

Homogenizing

A homogenizer can be used to finely mix small samples of seafood products. This piece of laboratory equipment is often used to homogenize samples of tissues, plants, soils, and others. Use the homogenizer when making gruel for small fish because making a 100 g formula for such a small animal is excessive. Use a 50 mL centrifuge tube to hold the seafood product (e.g. mysis) and water and then follow the manufacturer's instructions for using the homogenizer. The problem with homogenizers is heat generation. The seafood product thaws faster because the amount is so small; it does not stay cool as long as the larger fish formulas. The intense mixing of the homogenizer generates enough heat; it could be damaging vitamins and denaturing proteins. It is important to limit the mixing time to only as much as is needed (typically only 30 seconds or less) to prevent as much heat degradation as possible. Another disadvantage to the homogenizer is its cost, which can be over \$1,000.

Disadvantages of the NutriBullet® and Magic Bullet®

There are some drawbacks to using the NutriBullet® and Magic Bullet®. One, they can be expensive (though not nearly as expensive as the Waring blenders). NutriBullets® cost \$89.99 from the original manufacturer (www.nutriliving.com), and come with a few things that are probably not going to be used. Individual pieces are available (bases, mixing cups, and cross blades) from eBay and Amazon. Magic Bullets® are currently being offered for \$99.99 for 2 sets from the manufacturer (www.buythebullet.com). However, the set comes with many accessories that are useless (party cups and shaker tops) for zoological operations. The milling blades that come with both the NutriBullet® and Magic Bullet® sets can be used for some seafood items (such as pacifica krill), but in general they will not be able to grind up fish to the same degree as the cross blades. There is an ice chipper blade available for the Magic Bullet® that can be purchased separately.

Another disadvantage is that they tend to frequently break with high volume commissary use. Many of the problems associated with the Magic and NutriBullets® stem from the fact that the conditions of an aquarium's commissary are generally harsher than what they are designed for. The water environment is harsh on the Magic and NutriBullets®. If the blades are not fully tightened around the cup, when they blend, they leak, which eventually causes damage to the motor. The way the Magic and NutriBullets® are constructed makes them more difficult to clean than the Waring blenders. The gaskets in the blades are difficult to take out of the Magic Bullet®, but easier in the NutriBullet. The bases are more prone to water damage than the Waring blender bases, so more care needs to be taken when cleaning them. The constant washing and sanitizing takes a toll on the bushings of the blade assembly; they may seize up and a new blade will be needed (however, there have been improvements with the NutriBullet®). As previously stated, there are individual pieces, as well as spare parts for the blades, available on eBay and Amazon.

Disadvantages of the Waring blenders

The models previously stated can only process larger quantities of fish; however, Waring makes a smaller 1 L capacity blender, and their laboratory blenders have attachments for the 1 L blender that can grind even smaller quantities (12 - 250 mL). However, Waring blenders are very expensive. The models are between \$250 and \$1,000. The attachments for the 1 L blender are around \$300. These blenders are more durable than the Magic and NutriBullets®; however, when they do need replacement parts, they can be costly. As an example, a replacement blender container for the 2 L blender was nearly as much as the actual blender cost. The manual states that the blade assembly has a life expectancy of about 500 hours of running time depending on operating conditions (and grinding fish can be tough on grinders). Replacement blender parts can be purchased but a skilled technician is required; otherwise the blender must be sent to a Waring service center, or a new blender container must be bought.

Waring blenders will also generate heat when running for extended periods (although they should not be running continuously for more than three minutes). Even after repeated bouts of blending, fish formulas may warm up, which may cause heat degradation of proteins and vitamins. If a formula does not have any cold fish in it (such as milk replacement formulas), the use of cold water will only minimally offset the heat generation caused by the friction of the blades.

Conclusion

Fish can be successfully ground into a tube formula for the treatment of animals. Extra steps need to be taken to ensure the homogenization of the fish. Properly maintained blenders or other tools, such as meat grinders, are essential for this as well. There are a few disadvantages to each blender and each technique is only useful for certain applications, however, practice and experience will eventually optimize the process.

Figure 1. An example of a homogenizer, VWR model VDI 25 S41



Figure 2. From left to right: Waring Heavy Duty CB15 4 L capacity, Waring HGB160 2 L capacity, NutriBullet® with a tall cup next to it, Magic Bullet® with a tall cup next to it, 10 lb manual meat grinder.



Figure 3. Skinning a pacific herring fillet.



Figure 4. Skinning a capelin.



Figure 5. Filleting capelin.



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