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Review Article

A review of natural milk, commercial replacement formulas, and home-made substitutes used in the care of rescued manatee calves

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Abstract

In marine animal rehabilitation, people with a wide range of education and experience must be knowledgeable on the nutritional requirements of numerous marine species and especially their young that may become abandoned. The Florida manatee (*Trichechus manatus latirostris*) population has on average 10 calves per year requiring rehabilitation in that state alone. A review was undertaken to evaluate the efficacy of natural manatee milk (NMM) versus the various milk replacers or 'home-made' formulas fed to rescued manatee calves with respect to maintaining growth and adequate weight gain. Various databases (PubMed, Web of Knowledge, Google Scholar, Internet, etc) were searched (1979-2013) for any literature describing the composition and feeding of NMM and milk replacers to manatee calves. The Florida Fish and Wildlife Conservation Commission (FWC) website was used to identify the number of rescued manatee calves per year (9.67 ± 3.39, mean ± SD) from 2008 through 2013. Of the 4 research articles describing manatee milk composition and the use of various commercial or 'home-made' formulas, only 2 articles compared growth patterns with the type of milk formulas used. This scant amount of published data alone reveals the need for further research into the use of milk replacers versus NMM when feeding rescued manatee calves. The lack of knowledge in the use of milk replacers or their efficacy in maintaining healthy manatee calves underlines the need for further scientific studies and published results to clarify the proper nutritional requirements to successfully rehabilitate rescued manatee calves and better insure their successful release back into their natural environment. [JMATE. 2014;7(1):17-22]

Keywords: rehabilitation, weaning, orphans, Trichechus manatus latirostris

Introduction

The Florida manatee (*Trichechus manatus latirostris*) is an endangered marine mammal that is threatened due to both natural (red-tide blooms, cold water stress, diseases) and anthropogenic causes (water craft collisions, net/fishing gear entrapment) (2,5,19). Any of these causes might result in the death of lactating female manatees which would necessitate the capture, care, and weaning of orphaned manatee calves (2, 23). Rehabilitation of these unweaned rescued calves would involve additional specialized care to ensure successful release (Figure 1). An important part of this involves the proper feeding of the young manatee calf with some type of milk replacement to maintain its health, nutritional needs, and growth if it cannot be re-united with its mother. However, in general, it is often very difficult to hand-rear rescued marine mammal young due to the unique composition of their mother's milk or various changes of milk composition during lactation (4, 26).

At present, there is no commercial milk replacement specifically developed for the feeding of young manatee calves. As a result, numerous 'home made' recipes or commercially available milk replacers (*Esbilac*, PetAg, Il, USA, *Multi-milk*, PetAg, Il, USA) are used which have not been scientifically validated to be an acceptable milk replacer for young unweaned manatee calves. Therefore, a review was undertaken to compare the effects of feeding rescued manatee calves commercial replacement or 'home made' formulas versus natural manatee milk (NMM) on maintaining their growth and weight gain.

Figure 1: A young unweaned manatee calf. Copyright OERS. Reproduced with permission.

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Results

Number of Rescued Manatee Calves

The Florida Fish and Wildlife Conservation Commission website was searched to identify the number of rescued manatee calves from 2008 to 2013 (23). The number of rescued manatee calves during that time period was 44 (9.67 ± 3.39 per year, mean ± SD) and ranged between 6% to 15% of the total number of manatees rescued for each year. A large proportion of rescued manatee calves that were rescued died (24 out of 44 or 55%) and this population illustrated a large variability in mortality from year to year ranging from 30% to 83%. (Figure 2) There were no specific medical reasons given for the deaths of these calves, though cases of malnourishment, cachexia, disease, enteritis, and anatomical anomalies have been previously published (8, 13, 16, 24).

Figure 2: A young rescued calf being weighed . Copyright OERS. Reproduced with permission.

Scientific Publications Describing Various Feeding Regimes

Various databases (PubMed, Web of Knowledge, Google Scholar, Internet, etc.) were searched between 1979-2013 for research articles that described the feeding and care of rescued manatee calves using NMM or some type of milk replacer. Few articles were found (n= 4) which included 2 articles describing the scientific analysis and composition of manatee milk and 2 articles describing the use of NMM versus various 'home-made' milk replacement formulas that measured weight gain and body growth of manatee calves when fed either NNM or 'home-made milk replacers (1, 4, 15, 17). In comparison, there were a minimum of 9 papers reporting on the components of bottlenose dolphin (*Tursiops truncatus*) milk with one paper as far back as 1940 (11, 26).

There were numerous web sites of organizations that rehabilitate manatee calves which mentioned the use of artificial milk replacers when feeding and caring for this species of aquatic mammal. However, most did not elaborate on the composition of the formulas used, the specific brand of artificial milk replacers, or just stated that it was a milk replacer developed within their facility with no further description (10, 20, 27). These web sites provided neither useable scientific data with respect to NMM, artificial milk replacement, nor 'home-made' milk formulas and were therefore not used in this study.

Discussion

Variability Between Natural Milk and 'Home-made' Formulas

The health and growth of any species requires that the specific nutritional needs be met and this is especially true for their young (17). Specifically, in manatees, it has been reported that the nutritional needs of these calves has been challenging to provide and that the success of the available commercial milk products varies greatly (7). In mammals, these nutritional needs are obtained through the suckling and digestion of maternal milk until the young animal is weaned (25). The composition of maternal milk varies immensely between species, again largely dependant on the nutritional requirements of their young. Therefore, it is not advisable to directly feed the young of one species with maternal milk from another as this may cause numerous problems including diarrhea or enteritis (22). The variability of milk composition between species (humans, cow, cat, dog, marine mammals, etc) is well understood (25). Also, milk composition in marine mammals varies greatly and is unusual in its composition when compared to other mammalian species, thus great care must be given when rehabilitating the young of these species (4). As well, it has been reported in female polar bears and dolphins that their milk composition changes (fat, crude protein, water) over time and seasonally depending on the

activity of the mother, the age of their cubs or calves, or lactation stage (9, 26).

Attempts to adapt milk from one species (known as 'home-made' formulas) or artificial formulas (commercially made) to feed the young of another species have met with variable success (4, 6). In harbor seals, no statistically significant differences in survivability was detected between rehabilitated seal pups that were fed a commercially available formula up to 4 months of age to that of equivalently aged pups in the wild (12). However, that same study identified that rehabilitated pups had a steady decline in survivability after 4 months of age. Another study that examined twin gray seal pups that were fed a 'home-made' formula revealed that there was no promotion of normal growth or incremental weight gain when compared to wild pups (22).

Composition of Manatee Milk

Since 1979, only 2 studies specifically examined the composition of manatee milk (1, 17). The results of those studies revealed that manatee milk had high protein and lipid (mostly triglycerides) levels and low levels of lactose which is similar to other marine mammals. Interestingly, Bachman and Irvine also reported the salt content of manatee milk and compared that to bovine milk (1). Manatee milk had higher salt, sodium, and chloride content, but lower calcium, potassium and phosphorous concentrations when compared to bovine milk. All of these manatee milk components are significantly different from bovine milk and therefore may play a crucial role on how well a manatee calf may respond to certain 'home-made' milk replacers or artificial formulas using bovine milk. For instance, it is well known that manatee calves often suffer from diarrhea or enteritis which may be due to too much lactose commonly found in 'home-made' replacers which may use bovine milk in their recipes (22).

Body Growth and Feeding Rescued Manatee Calves

There are only 2 scientific papers that describe feeding rescued manatees calves. In 1982, Best *et al*. described the artificial feeding of 14 netted or abandoned manatee calves that required care (4). Three separate diets were used: Group I (n= 10) were fed using whole powdered milk with butter, Group II (n=2) were given a formula consisting of powdered soyabean milk and butter, and Group III (n=2) were fed whole powdered milk, butter including a banana, and all three groups had access to various soft aquatic vegetation. All of these calves exhibited an average weekly weight increase of 1 kg and a length growth rate of 1.4 cm which was comparable to a calf nursing from its mother that was reported earlier by Odell (14).

In 2012, Borges *et al.* described feeding 2 groups of manatee calves the following diets for 24 months: Group I (rescued calves, n=38) were fed various milk replacers based on whole milk or soybean protein along with supplements (vitamins) if required, and Group II (captive born fed by their mothers, n=9) (6). Both groups started at similar body weights (Group I- 34.6 kg, Group II- 34.2 kg). Calves born in captivity alongside their mothers had greater increases in their weights overall and at the end of the study, Group I (abandoned calves) had lower average body weights of 157 kg versus Group II (with mothers) 218.7 kg. Body length was non-significantly different (Group I- 199.1 cm versus Group II- 220.6 cm).

Various Formulations Unpublished

There are numerous facilities in Florida and elsewhere (Sea World of Florida, Miami Seaquarium, Georgia Aquarium, plus others) that have formulated their own milk replacement formulas to rehabilitate manatee calves depending upon their experience from previously treated cases, knowledge/experience of their staff, and other logistical considerations. As well, each manatee calf may require a specific milk replacer formula that has subtle changes made to it depending upon numerous factors such as the calf's nutritional requirements (age, amount of weight loss), causes for rehabilitation (trauma, hypothermia, etc), any nutritional challenges the calf may have (cachexia), or available ingredients. There are in existence many medical files that are filled with valuable practical experience and knowledge gained from the treatment of many manatee calves, however few of these detailed treatments are ever published. One such publication that contains this type of information is a Masters thesis written by S.L. Shapiro, however, it is extremely difficult to find either online or within any type of depository (21).

There are a few online reports of facilities using

commercially available milk replacement products (ie Esbilac, PetAg, Il, USA) or 'home made' recipes, however, they do not report any data such as body growth or weight gain of the young calves (10, 20. 27). This lack of information makes it difficult to substantiate any scientific comparison examining the efficacy of these products on rescued young manatee calves.

Conclusion

Rehabilitation facilities, aquariums, and zoos who care for young marine mammals must be knowledgeable on the unique dietary and nutritional needs of the various species and this seems especially true for abandoned and rescued manatee calves. However, the literature is lacking in scientific studies detailing the nutritional composition and benefits of using either milk replacers or natural milk in manatee calve husbandry. Further research in this area could contribute to better husbandry practices and thereby help decrease the number of deaths of abandoned manatee calves. (Figure 3)

Figure 3: A female manatee with her calf. Copyright OERS. Reproduced with permission.

This issue should be addressed as scientific data points to the possibility of large scale climatic events (more strong violent storms) having dramatic effects on certain marine mammal species which could result in higher numbers of abandoned young or strandings including manatees (18). Ensuring that abandoned manatee calves are properly nourished during rehabilitation through the use of natural milk, or a scientifically proven milk replacement formula, would increase the release of healthy fully grown calves back into their natural environment and improve their natural populations which play a role in future management practices and policies.

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