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Nutritional Requirements and Feed Management Practices in Small-Scale Aquaculture in Pedavadlapudi, Mangalagiri, Guntur

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Abstract:

Small-scale fish farming in Pedavadlapudi, Mangalagiri Mandal, and Guntur provides local jobs and food. Farmers face challenges in feeding fish. This study examined farmers' fish nutrition needs and feeding management, focusing on local resources such as rice bran, oilseed cakes, and food waste. Through surveys and farm visits, it assessed current practices, the nutritional value of local resources, and their impact on fish growth and water quality. This study aimed to identify knowledge gaps and suggest feeding improvements using local resources. The results will analyze practices, identify challenges, and provide advice for sustainable fish farming. This research will benefit farmers, agencies, policymakers, and aquaculture researchers.

Key Words: Small-scale aquaculture, Feed management, Nutritional requirements, Locally available resources, Rice bran, Oilseed cakes, Fruit/vegetable waste, Household surveys, Semi-structured interviews, On-farm observations, Growth performance, Health, Water quality, Knowledge gaps, Evidence-based strategies, Sustainability and Productivity

1.Introduction:

Aquaculture plays a significant role in the agricultural and economic landscape of Andhra Pradesh, particularly in districts such as Guntur. Small-scale aquaculture operations are prevalent in regions such as Pedavadlapudi within Mangalagiri Mandal and contribute to local livelihoods and food security. However, these operations often face challenges related to feed management, which is a critical factor that influences productivity, profitability, and environmental sustainability. Inefficient feeding practices and a lack of understanding of the specific nutritional requirements of cultured species can lead to suboptimal growth, increased disease susceptibility, poor water quality, and economic loss.

This study aimed to investigate the current nutritional requirements and feed management practices of small-scale aquaculture farmers in Pedavadlapudi, Mangalagiri, and Guntur, Specifically, it focuses on the utilization of locally available resources, such as rice bran, oilseed cakes, and fruit/vegetable waste, as feed components and assesses their nutritional contribution, limitations, and potential for optimization within cost-effective and sustainable feeding regimes. The findings of this study provide valuable insights into the development of targeted interventions and extension programs to improve feed management practices and to enhance the overall sustainability of small-scale aquaculture in the region.

https://maps.app.goo.gl/3oMfmPpGp7XeCJ9L7

https://en.wikipedia.org/wiki/Pedavadlapudi#/map/0

To achieve high levels of aquaculture production, fish farmers need nutritionally adequate and cost-effective feeds, which are coupled with good feed management practices. Access to high quality and cost-effective feeds is one of the prerequisites to successful fish farming. The fish feed industry has been boosted by the development of fish feed standards, which has ensured access to high-quality fish feeds by all farmers. Feed management practices considerably impact on the economic performance in fish production. Thus, adopting appropriate feed management technologies and feeding strategies is instrumental in maximizing aquaculture productivity. [1]

2. Literature Review:

Global and Indian Aquaculture: Overview of the aquaculture sector, its importance, and the dominance of small-scale operations in many regions, including Andhra Pradesh. Nutritional Requirements of Commonly Cultured Species in Guntur: Detailed review of the essential nutrients (protein, lipids, carbohydrates, vitamins and minerals) required by the dominant aquaculture species in the study area (e.g., Catla, Rohu, to be confirmed through preliminary surveys). These include species-specific needs at various stages of life.

Feed Management in Aquaculture: Best practices in feed formulation, processing, storage, and delivery. Emphasis should be placed on efficient feeding strategies to optimize growth, minimize waste, and maintain water quality. Utilization of agricultural by-products in aquaculture feeds: review of research on the use of rice bran, various oilseed cakes (groundnut, mustard, sesame, etc.), and fruit/vegetable waste as feed ingredients in aquaculture. This includes nutritional composition, digestibility, and potential anti nutritional factors, and processing methods to enhance their value.

Small-Scale Aquaculture Challenges in India: Specific challenges faced by small-scale farmers, including access to quality feed, financial constraints, technical knowledge gaps, and environmental management. Studies Conducted in Andhra Pradesh: Review of any existing research on aquaculture nutrition and feed management practices within the state, particularly in the Guntur region. This will help to identify existing knowledge gaps and build upon previous work.

3.1 Site Description: Study Area: Pedavadlapudi, Mangalagiri, Guntur:

Geography: Pedavadlapudi is situated southeast of the mandal headquarters, Mangalagiri,[2] at $16^0$24'35.21 "N $80^0$36'40.92"E. it covers an area of 949 ha [2350 acres].

Demographics: As of the 2011 Census of India, the town has a population of 13,076, with 3655 households. The total population comprised 6,552 males and 6, 524 women, with a sex ratio of 996 females per 1000 males, and 1,090 children aged 0–6 years, of which 535 were boys and 555 were girls. The average literacy rate is 73.63% with 8,585 literates which is approximately equal to the state average of 67.41%.[3]

Economy: Agriculture is the village's main occupation.[12] Hindustan Coca-Cola Beverages Private Limited, a bottling entity in Coca-Cola India, is situated in the village.[4] For trading and exporting agricultural products, there exists an *Agricultural Market Yard*.[5]

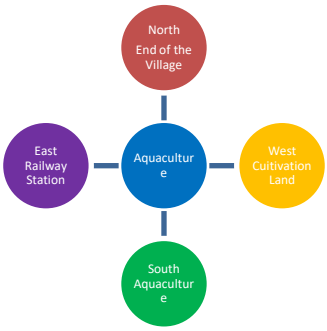
Study Area: The study area for the research was away from the residential area and towards Ippatam Road. The site is surrounded by agricultural –cultivation of flower gardens. The North side is the end of the village; the western side is the cultivation of flowers, the eastern side of the railway track, and beyond its cultivation land.

North: End of the Village

West: Cultivation Land

East: Railway Station

South: Aquaculture Pond



4. Methodology: Questionnaire Survey and Direct Interaction:

A structured and field survey was conducted in the village and small-scale farmers at Pedavadlapudi to assess nutritional requirements and feed management practices. The questionnaire included questions on the area and depth of the pond, density of feed usage per acre, chemical usage per acre, number of aerations per acre, probiotic usage, number of water changes per acre, environmental impact, and sustainability concerns. Sediment water is discharged before summer every year.

Survey was conducted to examine nutrition and feed management in small-scale aquaculture. Central to this study was a committed farmer whose work is closely linked to aquaculture.

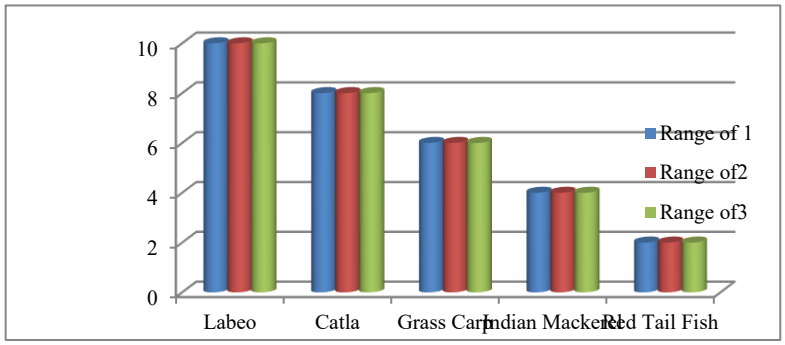
The survey aimed to investigate the feeding practices adopted by farmers; understand the nutritional needs of aquatic life; identify challenges in sourcing, storing, and utilizing feed; and document effective feed management strategies.

The survey employed various methodologies: 1. Questionnaire-based interviews: A carefully designed questionnaire was used to collect precise data. 2. Direct Interaction: Conversations with Mahesh provide qualitative insights. 3. Personal Contact Survey: Visits to the aquaculture unit offered a firsthand view of the practices in place.

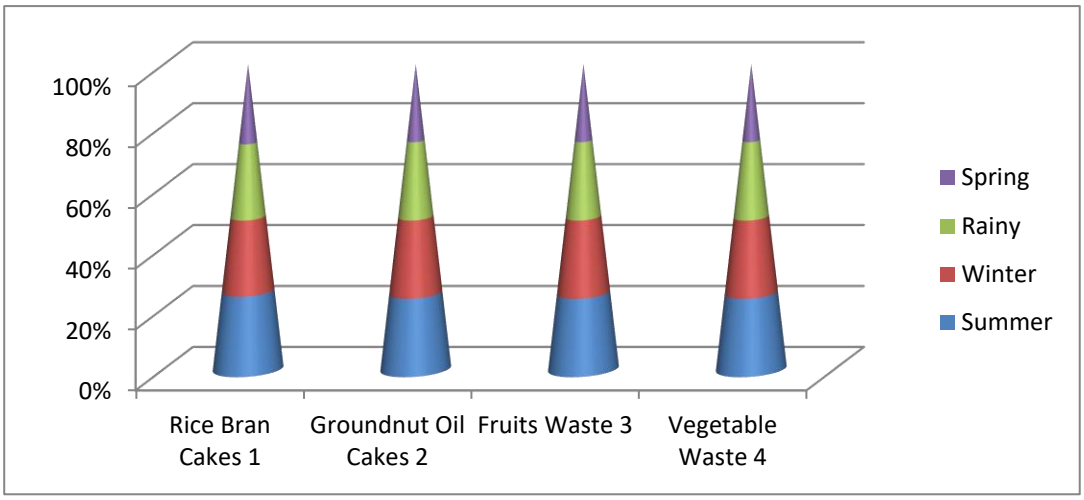
Nutritional practices: Farmers sources their feed from local suppliers, combining commercial pellets with farm-made supplements, such as rice bran and groundnut cake. He conducted manual feeding twice daily, estimating feed quantities based on fish biomass, without the aid of automated systems.

Feed Management Observations: Feed was stored in dry, elevated locations to protect it from moisture. Farmers assessed the feed quality based on their experience, as laboratory testing is not feasible. They managed the costs and availability by alternating between different feed brands, although issues such as feed waste and water pollution occasionally arose.

Species Cultivated: Five varieties of fish were cultivated, including 1.*Labeo rohita* (Rohu); 2. Catla (boche); 3.Ctenopharyngodon idellus grass carp; 4. Indian Mackerel and 5. Cyrrhinus marigala- Erra Mosu- red tail fish. Fingerlings weighing approximately 250grams weight of it being purchased from a market and cultivated in ponds.



Feed Management: Current feed management practices among farmers involve the daily morning feeding of fingerlings. The feed was stored in gunny bags and secured with rope. Locally available resources, such as rice bran cakes, groundnut oil seed cakes, and fruit and vegetable waste, are utilized as feed components in aquaculture. Farmers perceive the nutritional value and availability of these local feed resources to contain approximately 20-45% crude protein. The protein and mineral contents off fruit and vegetable wastes were noted. Oil cakes, specifically rice bran and groundnut, serve as a primary food source in aquaculture and are, utilized at a rate of 95% across the four seasons: spring, rainy, winter, and summer. Fruit and vegetable wastes were employed at a minimum rate of 10% - 20%.



Profile: Farmers acknowledge that while oil cakes are rich in protein for terrestrial animals, they may not offer the complete and balanced amino acid profile necessary for optimal growth and health of fish. Aquatic animals have specific essential amino acid requirements, and exclusive reliance on oil cakes can result in slower growth rates, reduced feed conversion ratios (FCR), and heightened susceptibility to diseases due to nutritional deficiencies.

High fat content and water quality issues: Certain oil cakes possess a high fat content, which can leach into the water, leading to water quality deterioration, such as oil slicks and reduced dissolved oxygen levels, and potentially fouling the culture environment. Poor water quality imposes stress on aquatic animals, increasing their vulnerability to diseases and mortality. Thus, managing the fat content and its impact on water quality has become a significant concern.

Binding Properties and Water Stability: In their raw form, oil cakes often lack the binding properties required to create water-stable pellets or feed particles, leading to rapid disintegration of water, nutrient loss, and water pollution. This necessitates additional processing or mixing with binding agents, thereby increasing the labor and potential costs. Rapid disintegration also hinders efficient consumption of feed by aquatic animals. Decomposing oil cakes in water can attract undesirable bacteria, fungi, and other organisms that compete with cultured species for oxygen and nutrients or introduce diseases. Maintaining a healthy and balanced aquatic environment has become more challenging with the introduction of raw oil cake.

Rice bran, even in cake form, can leach nutrients into the water relatively quickly, contributing to water quality issues and nutrient loss. This necessitates frequent feeding, which can lead to environmental degradation in the culture system. Similar to oil cakes, rice bran cakes may lack sufficient binding properties to maintain their structure in water for extended periods of time, resulting in feed disintegration, nutrient loss, and water pollution.

Although rice bran contains some protein, its overall protein content is generally lower than that of specialized aquaculture feeds formulated to meet the high protein demand of fast-growing fish. The heavy reliance on rice bran cakes may not provide sufficient protein for optimal growth and production. Depending on the agricultural practices employed in rice cultivation, there may be concerns regarding pesticide residues in rice bran, which could adversely affect the health of cultured species and pose risks to human consumers. To mitigate this risk, farmers must exercise caution regarding the source of rice bran.

Ensuring optimal water quality is of the utmost importance in aquaculture, and farmers exercise caution regarding feed ingredients that may adversely affect it. Inadequate nutrition and water quality are significant predisposing factors for diseases in aquaculture, prompting farmers to be cautious about feed that could compromise the health of their stocks.

Aquaculture is a high-intensity operation in which growth rates, feed conversion ratios, and survival rates are meticulously monitored. Farmers perceive that exclusive reliance on local resources may not achieve the same performance levels as formulated feed. Depending on the target market, regulations or market standards concerning the type and quality of feed used in aquaculture may exist.

Growth Performance: Aquatic animals may not efficiently digest proteins in these plant-based resources compared with animal-based proteins in formulated feeds, which can hinder digestion and nutrient absorption in some species. Consequently, a greater quantity of these feed resources is required to achieve the same growth as formulated feeds, rendering the feeding process less efficient and costly over the long term. Variable Growth: Due to inconsistencies in the quality and nutritional content of locally sourced oil cakes and rice bran, growth performance within the same batch of cultured animals can be uneven.

Health Status: Nutritional imbalances and deficiencies can compromise the immune systems of fish and shrimp, rendering them more susceptible to bacterial, fungal, and parasitic infections. Suboptimal nutrition can induce chronic stress, diminishing the ability of animals to cope with environmental fluctuations (e.g., temperature and oxygen levels) and handling. Depending on the specific deficiencies, farmers may observe symptoms such as fin erosion, deformities, poor pigmentation, and reduced reproductive performance.

Overall Productivity: Reduced Yields: Diminished growth rates and elevated mortality rates directly result in decreased overall production yield from aquaculture farms. Increased Production Costs: A higher Feed Conversion Ratio (FCR) necessitates more feed per unit of output, thereby escalating feed costs, which typically constitutes the largest operational expense in aquaculture. Additional expenses may also arise from disease treatment and the management of water quality issues associated with these feeds. Water Quality Issues: As previously mentioned, the high fat content of certain oil cakes and nutrient leaching from rice

bran can degrade the water quality, creating a stressful environment for cultured species and potentially leading to mortality. This situation necessitates enhanced water management efforts and the associated costs.

Marketability Concerns: Animals that have not achieved optimal growth or exhibit signs of poor health may be less marketable or command lower prices. In India, particularly in regions such as Andhra Pradesh with significant aquaculture activity, farmers' knowledge levels and attitudes towards optimal nutritional requirements and feed management practices are diverse and influenced by several factors.

Variable Levels of Understanding: Traditional Knowledge: Many farmers rely heavily on traditional knowledge passed down through generations, which may not always align with the scientifically validated nutritional requirements of specific aquaculture species and their different life stages. Farmers also learn from their own experiences and observe the growth and health of their stock based on different feeding practices. This practical knowledge is valuable but can be limited by a lack of controlled experimentation and understanding of the underlying nutritional principles.

Limited Scientific Knowledge: A significant portion of small-scale farmers may have limited formal knowledge about the specific proteins, carbohydrates, lipids, vitamins, and mineral needs of their cultured species. They may not be aware of the importance of a balanced diet and the consequences of nutritional deficiencies or excesses.

Cost sensitivity in feed management is a significant concern for farmers, often resulting in a preference for less expensive, locally sourced resources, despite their potentially suboptimal nutritional value. Farmers may be reluctant to adopt novel or unfamiliar feeding practices because of the perceived risks of diminished production or financial loss. There is a strong tendency to adhere to established local practices that have been used for years, even when more efficient methods are available.

The availability and cost of labor can influence feeding frequency and methods, with manual feeding remaining prevalent and labor-intensive practices being generally avoided. Farmers frequently assess feed quality based on the visual appearance, smell, and immediate response of their livestock, which may not always accurately reflect their nutritional value. The fluctuating cost of feed over time affects expenses incurred by farmers and those involved in aquaculture. Consequently, farmers seek strategies for effective feed management.

Potential Table:

S.No	Challenges	Impact on Aquaculture
1	Ground water Contamination	Increased disease outbreaks, reduced productivity
2	**High feed cost**	**Increased operational expenses**
3	Market Price fluctuations	Revenue instability
4	Disease outbreaks	High mortality loss of investment
5	Environmental regulations	Compliance costs
6	Natural disasters (floods)	Infrastructure damage, delayed recovery

Potential Opportunities for Improving Feed Management:

Enhanced Utilization of Local Resources: Enhancing Nutritional Value: There opportunities to augment the nutritional content of local resources, such as oil cakes and rice bran, through straightforward processing methods (e.g., pelleting, fermentation, and grinding) and fortification with essential nutrients that may be deficient. Educating farmers on the strategic combination of various local resources can facilitate the creation of more balanced diets that fulfill the fundamental nutritional requirements of their livestock, thereby diminishing reliance on singular, incomplete feeds.

Sustainable Sourcing: Advocating sustainable sourcing and storage of local feed resources can enhance their quality and mitigate the risks of spoilage and mycotoxin contamination. Encouraging the cultivation of high-protein or nutrient-rich plants (e.g., Azolla and duckweed) on or near farms can offer fresh and cost-effective feed supplements.

Potential Constraints for Enhancing Feed Management:

Economic Limitations: The financial burden associated with processing equipment, supplements, formulated feeds, and feed testing can be prohibitive to small-scale farmers. The reach and efficacy of extension services in disseminating scientifically accurate information is limited. Language barriers and varying literacy levels also pose a challenge. The absence of adequate storage facilities, transportation networks, and processing infrastructure can impede efficient utilization of local resources. Resistance to change, reliance on traditional practices, and lack of trust in external advice can serve as significant barriers to the adoption of new technologies and approaches. The quality and availability of local feed ingredients can fluctuate seasonally and geographically which complicates the formulation of consistent and balanced diets. Some farmers prioritize immediate cost savings to understand the long-term benefits of optimal nutrition on growth, health, and overall productivity.

Regulatory Frameworks: The absence or lack of enforcement of feed quality standards can perpetuate the use of low-quality or adulterated feed resources. Addressing these constraints requires a multifaceted approach that involves government support, research institutions, extension agencies, the private sector, and farmers' active participation. By addressing knowledge gaps, economic limitations, and infrastructural challenges while leveraging opportunities for local resource utilization and scientific advancements, significant improvements in aquaculture feed management and overall farm productivity can be achieved in India. This detailed research proposal provides a framework for investigating nutritional requirements and feed management practices in small-scale aquaculture in Pedavadlapudi Mangalagiri, Guntur. These findings contribute valuable knowledge to enhance the sustainability and productivity of vital aquaculture systems.

Recommendation and Mitigation Strategies for Aquaculture in Pedavadlapudi:

1. Region-Specific Feed Formulation: Craft feed recipes that dance in harmony with the local aquatic symphony, perfectly attuned to the needs of the cultured species and the unique water quality of the region. Mitigation: Harnessing the bounty of local agro-industrial by-

products to weave a tapestry of sustainable feed, reducing reliance on commercial options and curbing waste.

2. Optimized Feeding Practices: Designing feeding schedules that ebb and flow with the rhythm of biomass and growth stages. Mitigation: Deploy demand feeders as vigilant sentinels, ensuring that every morsel is saved and that excess feed is a distant memory.

3. Water Quality Management: Embark on regular aquatic odysseys and test the water for pH, dissolved oxygen, and ammonia levels. Mitigation: Fine-tune feed protein levels to the melody of water quality, preventing any discordant deterioration.

4. Farmer Education: Illuminate the path with training on feed management and health practices, in collaboration with fisheries departments. Mitigation: This fosters the embrace of scientific feeding practices; reduce feed losses and nurtures a culture of knowledge.

5. Manure and Silt Management: Clear the pond's stage of bottom sludge and repurposing it for agricultural endeavors. Mitigation: This prevents nutrient build-up and reduces the risk of disease.

6. Policy Support: Advocates for government support, championing feed subsidies and quality control. Mitigation: This ensures a steady supply of quality feed, warding off shadows of substandard materials.

5. Results:

Water Quality Parameters: In tranquil world of ponds, those burdened by overfeeding revealed a dramatic rise in Biological Oxygen Demand (BOD), casting a shadow over their more disciplined counterparts. The depths of these overfed waters whispered secrets of elevated ammonia (NH_3) and the presence of hydrogen sulfide (H_2S). Where leftover feed was abundant the life-giving dissolved oxygen (DO) dwindled, especially at the pond's shadowy depths. Ponds awashed with nutrients from inefficient feeding or subpar feeds found themselves cloaked in murky turbidity, with pH levels dancing to an altered level. Feed Utilization: Systems that stumbled with inefficient feeding or relied on low-quality feeds bore witness to soaring Feed Conversion Ratios (FCR), a testament to the feed's journey from administration to biomass. Nutrient Levels: Ponds nourished by low-quality feeds rich in nutrients or plagued by poor feed utilization saw a surge in total phosphorus and total nitrogen, both in the water embrace and sediments grasp. Biological Indicators: High nutrient loading transformed ponds into vibrant canvases of algal blooms, their intensity measured by chlorophyll-a levels or the eye's keen observation. Signs of stress or mortality haunted the cultured species in ponds where the water quality was faltered, marked by high ammonia, low DO, and elevated H_2S levels. The benthic community also experienced tremors of change, reshaping itself in response to the accumulation of organic matter and the shifting chemistry of the waters.

6. Discussion:

The silent menace of uneaten feed lurks beneath the water surface is a formidable source of organic pollutants. As it decomposes, it siphons away precious dissolved oxygen while unleashing a toxic cocktail of ammonia and hydrogen sulfide. This noxious brew creates a

hostile habitat for cultured organisms, amplifying their stress, vulnerability to disease, and even mortality. The quest for rapid growth, if not meticulously orchestrated with precise feeding rates and schedules, can unwittingly unravel the delicate tapestry of water quality. Inefficient Feed Utilization and Resource Waste: A towering FCR is a glaring beacon of inefficiency, signaling that a large portion of feed input fails to metamorphose into coveted biomass. This not only bleeds economic resources from aquaculture operations, but also floods the aquatic realm with excess nutrients. More feed translates to more nitrogen and phosphorus infiltrating the system, thereby increasing the possibility of eutrophication. The trade-off between low-quality feeds: Opting for low-quality feeds laden with phosphorus and nitrogen may offer fleeting financial relief, but the environmental toll can be profound. A surge in nutrient discharge from these feeds acts as a potent elixir for algal proliferation, causing eutrophication and its attendant woes. This underscores the importance of weighing the environmental footprint along with the economic calculus of the feed. Interconnectedness of Impacts: It crucial to acknowledge the intricate web of these issues. Overfeeding, for instance, can inflate the FCR (as feed is squandered), while low-quality feeds, being less digestible, also elevate FCR and nutrient excretion. The ensuing decline in water quality from any of these practices can further impair feed utilization by cultured organisms resulting in a vicious cycle of degradation.

7. Conclusion:

Inadequate feed management practices, such as overfeeding, elevated Feed Conversion Ratios, and utilization of low-quality feeds, present substantial threats to the environmental sustainability of aquaculture. These practices result in increased nutrient loading and deterioration of water quality, as evidenced by elevated levels of BOD, ammonia, and hydrogen sulfide, and contribute to eutrophication and harmful algal blooms. To mitigate these adverse environmental impacts, aquaculture operations must prioritize optimized feeding strategies, employ natural feeds with appropriate nutrient profiles and digestibility, and implement effective monitoring and management practices to ensure efficient feed utilization and minimize nutrient discharge into aquatic environments. Further research and the adoption of best management practices in feed management are essential for promoting a more environmentally responsible and sustainable aquaculture industry.

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Ethics Statement: In this study, we prioritized ethical considerations. Prior to each interview, the participants were informed about the study's objectives, procedures, and their right to withdraw at any time. The interview data were securely stored and utilized solely for the purposes of this research.

Conflicts of Interest: The authors declare no conflict of interest.

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8. References:

1. 1.Fish feeds and feed management practices in the Kenyan aquaculture sector: Challenges and opportunities, Jonathan Munguti, Kevin Obiero, James Kirimi, David Liti, Erick Ogello, Hannington Odame, Calendar, Jan 2021,Aquatic Ecosystem Health & Management
2. "District Census Handbook : Guntur (Part A)" (PDF). *Census of India. Directorate of Census Operations, Andhra Pradesh. 2011. pp. 5,* 364*–365*. Retrieved 5 June 2019.
3. "Literacy of AP (Census 2011)" (PDF). *Official Portal of Andhra Pradesh Government. p. 43. Archived from* the original (PDF) *on 14 July 2014*. Retrieved 5 September 2014.
4. *4* ."Workshop on farm technologies held". *The Hindu. 5 November 2007.* ISSN 0971-751X. Retrieved 25 April 2016.
5. "Create awareness on State's welfare schemes, says Speaker". *The Hindu. Tenali. 11 August 2012*. Retrieved 11 August 2012.
6. Self Citation referring the books.