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Taste- Test Report

FishFirst! Zambia Research for Development and Scaling up Staple-Fish Products for Enhanced Nutrition in the First 1,000 Days of Life.

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About WorldFish

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world. Headquartered in Penang, Malaysia and with regional offices across Africa, Asia and the Pacific, WorldFish is a member of CGIAR, the world's largest global partnership on agriculture research and innovation for a food secure future.

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ASF	Animal source foods
ComFA+	Complementary Food for Africa + dried fish powder
EPA	eicosapentaenoic acid
DHA	docosahexaenoic acid
FPP	Fish protein powder
MSU	Mississippi State University
WRA	Women of Reproductive Age
IYC	Infant and Young Child
DGLV	Dark Green Leafy Vegetables
FPP	Fish Protein Powder

1.0 EXECUTIVE SUMMARY

Background: Worldwide, feeding practices for children aged 6–23 months do not meet the global recommendations. To contribute towards adequate nutrition for Infants and Young Children, WorldFish, and Mississippi State University (MSU), are implementing the "FishFirst! Zambia: Research for Development and Scaling Staple- Fish Products for Enhanced Nutrition in the First 1,000 Days of Life" project. The research activity conducted a taste-test study for Complementary Food for Africa + dried fish powder (ComFA+-traditional dishes).

Methodology: A taste-test study to collect data on the acceptability of ComFA+-traditional dishes among Mother/Child pairs with children aged 6-23 months was conducted in June 2022 in the Southern Province of Zambia. Participants came from three districts, namely Gwembe, Siavonga and Sinazongwe. The districts were selected because they lie along the lake Kariba Catchment area where the sardine *Limnothrissa miodon*, locally known as Kapenta, is produced, guaranteeing fish powder availability from Kapenta. The data was collected using two acceptability scales. The first scale was an infant acceptability scale, and the second was a 5-point organoleptic scale to measure the acceptability of dishes for mothers. Scale parameters for each attribute were described using frequencies. The ages of mothers and children were summarized using mean (SD). Kruskal Wallis Test was carried out to check for differences in food preferences of ComFA+traditional dishes. The data was analyzed by SPSS software.

Results: Up to 42 mothers participated in the taste-test study. A total of 14 mothers came from each of the targeted districts: Gwembe, Sinazongwe and Siavonga. Overall, the mean (SD) ages of the mothers and children were 27.5 (6.4) years and 13.0 (6.4) years, respectively. There were more female children, 57.1% (24/42), than males, 42.9% (18/42). Mothers' ComFA+ Taste-Test overall acceptability results showed that ComFA+Kapenta chutney was extremely liked by up to 97.6% (41/42) mothers, followed by ComFA+Chibwabwa Fisashi and ComFA+maize porridge with up to 95.2% (40/42) and 66.7% (28/42) respectively. ComFA+Bean-Vegetable Soup was recorded as the least liked food, with up to 54.2% (13/24) of mothers extremely liking the dish. There were significant differences in the liking of the four ComFA+ traditional dishes ($p<0.001$), with the difference mainly explained by the ComFA+Bean-Vegetable Soup. Age, nutritional knowledge, attitude, social, economic and culture are some of the factors that affect taste preferences. In the Sensory Trial II– Children's Taste-Test study revealed that children aged 6-23 months generally liked the ComFA+Maize Porridge. Up to 81.2% (13/16) of infants aged 6-11 months, as well as 88.5% (23/26) of children aged12-23 months extremely liked the porridge at Time 3 (T3). The study has also revealed that the taste preferences and quantity consumed are influenced by the age of children.

Conclusion: The intervention strategies for fish powder based nutrition recipes targeting the first 1,000 Days of Life ought to consider sensory pleasure response to foods, demographic and sociocultural variables.

2.0 INTRODUCTION

Worldwide, feeding practices for children aged 6–23 months do not meet the global recommendations. Improper feeding may explain why around 45% of deaths among children under five years of age are linked to undernutrition. Most of these deaths occur in low- and middle-income countries (LMICS), where childhood overweight and obesity rates are also rising (UNICEF & GSO, 2015, WHO, 2018, WHO, 2021). In Zambia, malnutrition levels are high, with stunting levels among under-five children at 35% (CSO, 2020). Table 1 shows the current stunting levels in the world and in Zambia (Table 1).

Table 1 Prevalence of Stunting

	WHO medium prevalence	Global[a]	Africa[a]	Zambia[b]		
				Males	Females	Average
Children <5 years of age	10 to <20%	22.2%	30.3%	38.3	31.0	34.6

Source: WHO global nutrition report 2021; b: Zambia Statistics Agency, Zambia demographic and health survey 2018; c: De Onis et al., 2019

Furthermore, micronutrient deficiencies remain among important global health issues (Hannah and Max, 2017). The World Health Organization (WHO) estimate that more than two billion people suffer from micronutrient deficiency globally (Hannah and Max, 2017). Effects of micronutrient deficiencies include poor physical and mental development in children, vulnerability or exacerbation of diseases, mental retardation, blindness and general losses in productivity and potential (Hannah and Max, 2017). Unlike energy-protein undernourishment, the health impacts of micronutrient deficiency are not always acutely visible; it is, therefore, sometimes termed ‘hidden hunger’ (Hannah and Max, 2017).

Feeding Practices contribute to malnutrition. The WHO and UNICEF developed ten indicators in 2008 and updated them in 2021 to measure feeding practices among children aged 6-23 months (Daelmans et al., 2009). One of the indicators promotes the consumption of animal-source foods (AFS) such as eggs and or flesh foods (Indikit, 2022). This group includes fish. Animal-source foods are important to feed children aged 6 to 23 months because these foods promote increased intake of the nutrients essential for reaching growth potential. Plant-based complementary foods are insufficient to meet the needs for essential micronutrients (Indikit, 2022, UNICEF, 2021). Therefore, meat, poultry, fish, or eggs are recommended to be part of the daily diet or eaten as often as possible micronutrients (Indikit, 2022, UNICEF, 2021).

Globally eggs and/or flesh consumption for children 6 to 23 months is at 45% micronutrients (UNICEF, 2021). In Zambia, meat, fish, and poultry are consumed by 40% of breastfeeding children and 47% of non-breastfeeding children (CSO, 2020).

Fish and other aquatic foods grown in and harvested from oceans, lakes, rivers and ponds represent an important component of the human diet, providing about 3.1 billion people with almost 20 per cent of their average daily animal protein intake (Gennari et al., 2015). Fish also provides the only readily available dietary source of long-chain omega-3 polyunsaturated fatty acids for direct human consumption (including eicosapentaenoic acid or EPA and docosahexaenoic acid or DHA (Sargentl & Tacon, 1999, Joordens et al., 2014, Tacon & Metian, 2017).

Elsewhere acceptability of fish-based recipes has been documented. For instance, in a review of hedonically screened products with 3%, 5%, 7% and 9% fish protein powder (FPP), the snack with the highest level of fish protein (7%) was preferred in the acceptance tests (Shaviklo, 2015). The tested products were seasoned with cheese powder, vegetable oil, salt, and colorant. Once processed, the FPP for addition to various recipes maintains its properties for six months at 5°C but loses the desirable properties rapidly when stored at 30 °C (Shaviklo, 2015). Deterioration of the FPP during storage is prevented by lowering the product's moisture content and eliminating oxygen from the package. The FPP can be applied as a functional ingredient for developing formulated ready-to-eat products (Shaviklo, 2015).

2.1 PURPOSE OF THE STUDY

As a way of contributing towards adequate nutrition for Infants and Young Children, WorldFish, in collaboration with Mississippi State University (MSU), is implementing the "FishFirst! Zambia: Research for Development and Scaling Staple-Fish Products for Enhanced Nutrition in the First 1,000 Days of Life" project by promoting ComFA+. ComFA+ stands for "Complementary Food for Africa+Dried Fish Powder." The key ingredient of ComFA+ is locally sourced small pelagic fish such as Kapenta or Chisense that are dried, roasted to remove any 'fishy' taste, and ground into a fine powder. This dried fish powder is then mixed with other nutritious ingredients that are also locally sourced – such as groundnut powder, orange-fleshed sweet potato, soybean powder and pumpkin leaves. The fish powder is mixed with these ingredients to improve the nutritional benefits of complementary foods for children aged 6-23 months and other household foods for women of reproductive age (WRA) between 15-49 years (WHO, 2010) and other household members. In this study, ComFA+ was added to four traditional dishes to increase

their nutritional content for children aged 6-23 months, WRA, and other household members. These dishes included: 1) Maize meal porridge, 2) Kapenta Chutney, 3) Chibwabwa Fisashi (a dark green leafy vegetable (DGLV) dish made from dried pumpkin leaves, and 4) Bean-Vegetable Soup.

2.2 AIM

This research activity aimed to conduct a taste test among mother/child pairs fed ComFA+-fortified traditional dishes.

2.2.1 Specific Objectives

2.2.1.1 Identify whether mothers find cooking/using the ComFA+Fish recipes and powders to fortify foods for children ages 6-23 months as convenient and congruent with meal planning and preparation as non- ComFA+Fish.

2.2.1.2. Conduct a small pilot test of the sensory acceptability (i.e., appearance, texture, and flavor) of ComFA+Fish recipes among mothers of children ages 6-23 months. Adjust product recipe as necessary.

2.2.1.3 Conduct a sensory panel among mother/child pairs to test the sensory acceptability of ComFA+Maize Porridge.

3.0 METHODOLOGY

3.1 SETTING AND PARTICIPANTS

The Taste-test study on ComFA+traditional dishes was conducted in the three districts in the Southern Province of Zambia. These districts are Gwembe, Siavonga and Sinazongwe. The three districts were selected because they are situated along the lake Kariba catchment area, where the sardine *Limnothrissa miodon*, locally known as Kapenta, suitable for making fish powder, is readily available. Lake Kariba is located on the Zambezi River in a tropical area with seasonal rainfall between latitudes 1628′ to 1804′ S and longitudes 2642′ to 2903′ E (Citypopulation, 2016). As of the 2010 census, the population in Gwembe, Siavonga and Sinazongwe was 53,117, 42,869, and 101,617, respectively (Citypopulation, 2016). Figure 1 shows Southern Province Map with taste-test sites. Districts are in different colours.

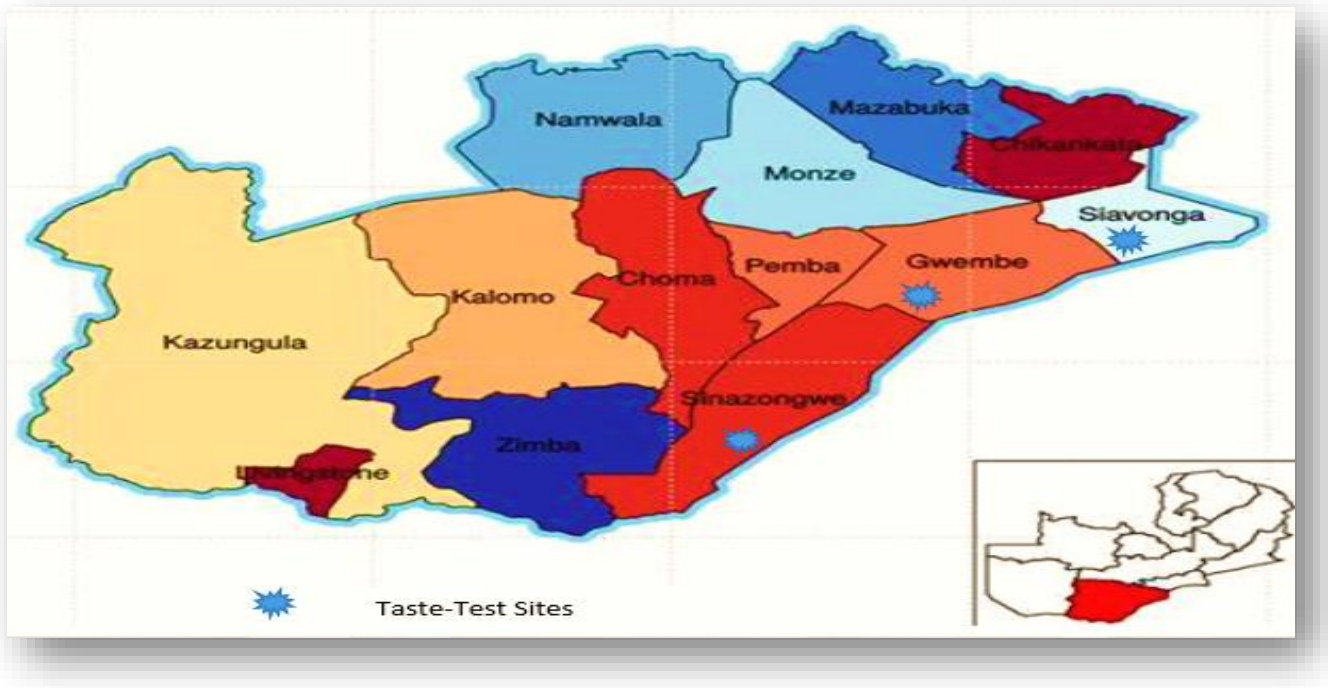

Figure 1 Southern Province Taste-Test Sites

Source: https://www.bing.com/images/search?view

3.2 TASTE-TEST STUDY

3.2.1 Organoleptic Evaluation

Organoleptic evaluation means the study of foods using sense organs. It refers to analysis methods that use attributes like color, odor, taste, size, shape, and special features, such as touch, texture, and many more (Jaffe et al., 2017). The mothers were asked to judge the four ComFA+traditional dishes on seven traits: aroma, appearance, texture, flavor, sweetness,

convenience, and overall acceptability. The LEXICON scale was used to rate the traits (Jaffe et al., 2017). The LEXICON scale is a 5-point scale which ranges from dislike very much to like very much.

3.2.2 ComFA+fortified traditional dishes

Figure 5 shows the ComFA+fortified traditional dishes prepared from Kapenta powder and locally available ingredients. These are Fish bean soup, Maize meal porridge, Kapenta Chutney and Chibwabwa/Fisashi. Chibwabwa/Fisashi is boiled pumpkin leaves to which pounded groundnuts have been added. It is a delicacy in most Zambian households (figure 2).

Figure 2 Comfa+Fortified Traditional Dishes

3.2.3. Taste-test Informed consent

The facilitators explained purpose of the taste-test activity for both the mother and infant to the mothers in vernacular. Mothers were assured that the data collected was anonymous and would be treated confidentially. Mothers were also asked for permission to photograph and video record images that could be used in project-related activities, including both print and online publications. The facilitators explained all the ingredients included in the recipes. They informed mothers that all children who had not consumed any of the ingredients before would not take part in the taste test to avoid potential allergic reactions. Mothers were informed that participating in the taste test was voluntary. Mothers were given contact for any questions related to the study they could have. Lastly, they were asked to sign consent and child

permission forms to show that the study had been explained and that they voluntarily agreed to participate and allowed their children to participate. All mothers opted to be part of the taste test activity.

3.2.4. Eligibility criteria

After they consented to be part of the taste test study, the mother and child pairs were screened for possible allergies. The mother/child pairs were eligible to participate in the taste study if the mother and child had no known allergies. In addition, the child with a history of eating fish-based foods and maize porridge was eligible (figure 3).

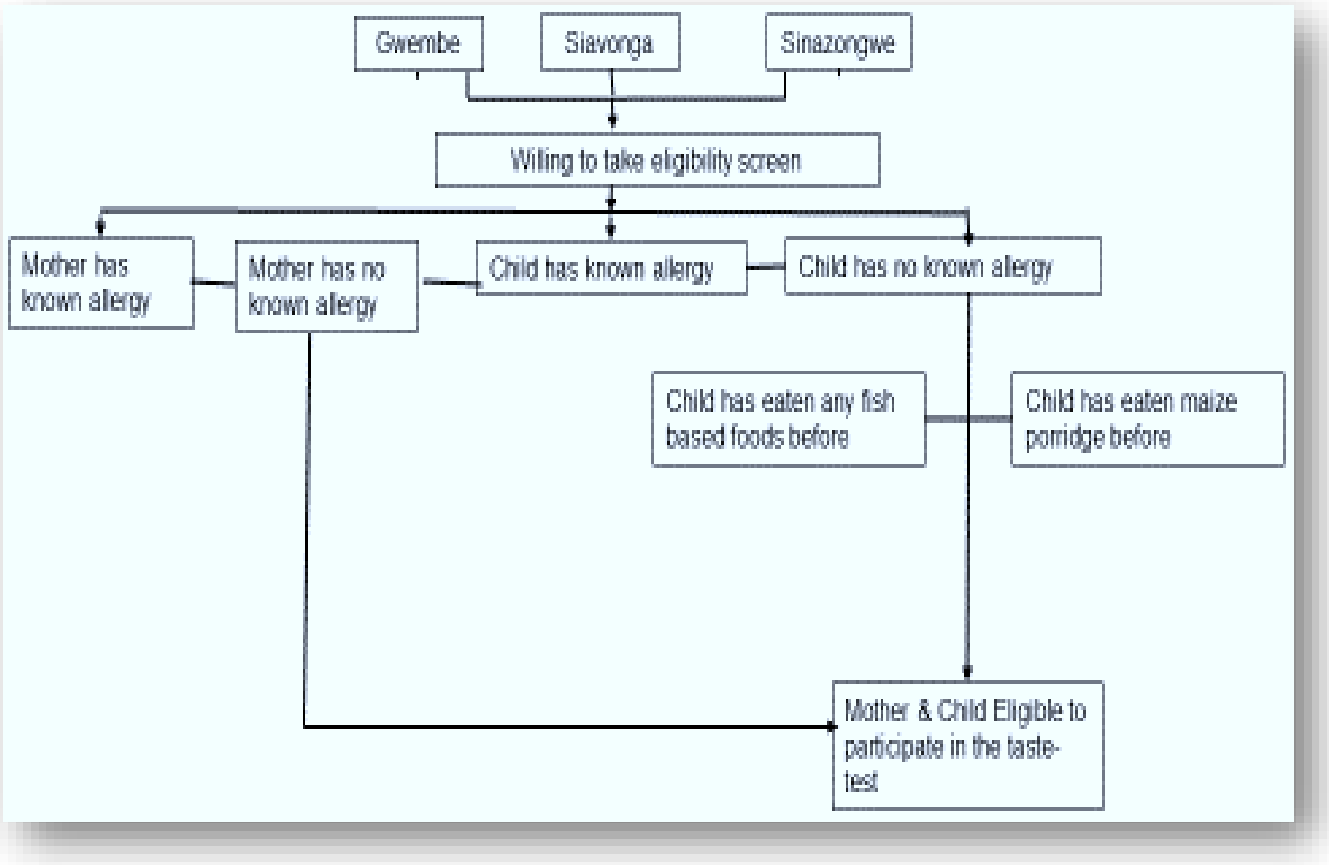

Figure 3 Eligibility Criteria

3.2.5. Mothers' Acceptability Scale (Scale 1)

Mothers were given pens and divided into four groups. The group took turns evaluating the different dishes. While the groups moved in rotation from one food station to the next, two facilitators who spoke the vernacular were stationed at a food-tasting station. The facilitators would welcome each new group, distribute evaluation forms, guide the mothers on completing the form and collect them when everyone had evaluated food at that station and before the group moved on to the next food-tasting station.

To guide the mothers, the trained group facilitators read the questions on the form and possible

answers one at a time. They asked the mothers to select and tick their responses on the form privately without sharing their views with anyone. Facilitators would only move to the next question after all group members had filled in their answers. Due to the low literacy levels of most of the mothers, this type of facilitation helped the mothers to have a shared understanding and to ensure they answered all questions. Traits to judge and assess were explained to the mothers (figure 4). The mothers judged the food on the following traits: aroma, appearance, texture, flavor, sweetness, convenience, and overall acceptability.

Figure 4 Mothers Acceptability Scale (Scale 1)

3.2.6. Infants' Acceptability Scale for Mothers (scale 2)

Mother/child pairs later participated in the Taste-Test study part 2. The same logistical procedures as those used for the Mother Acceptability Scale taste test were used. For the Infant's Acceptability Scale taste test, the mothers were asked to feed their children a small portion of ComFA+Maize porridge to which ComFA+ has been added. They were asked to report whether their child liked or disliked the porridge using the Infants' Acceptability Scale for Mothers. Figure 5 shows how the mothers were guided through the process of completing the form.

Figure 5 Guiding Mothers through the Process of Completing the Form

The mothers were asked to evaluate or judge whether their child had a positive or negative reaction to the food at three different times of tasting the food indicated as TIME 1, TIME 2, and TIME 3. The reaction was rated using the Infants Acceptability Scale for Mothers (Scale 2). The taste test for infants lasted for about 2 hours (Figure 6).

Figure 6 Infants Acceptability Scale for Mothers (Scale 2)

4.0 SENSORY TRIAL I RESULTS

4.1 CHARACTERIZATION OF MOTHER/CHILD PAIRS

The FishFirst! Zambia team conducted the Infants' ComFA+ Taste-Test (sensory panel) among mothers aged 18-49 years (N=42) who were mothers of children aged 6-23 months (N=42). Eighteen years of age is the legal age of consent in the US and other parts of the world, Zambia inclusive (Parmar et al., 2016). The mothers were recruited from the Districts of Gwembe (n=14), Siavonga (n=14), and Sinazongwe (n=14) in Zambia's Southern Province, located along the Lake Kariba catchment area. This vast lake is the leading source of *Limnothrissa miodon* – locally known as Kapenta – for Zambia and the Democratic Republic of Congo (FAO, 2004). The overall mean age of mothers was 27.5 (6.4) years, while for the

children, it was 13.0 (4.9) years. There were more female children 57.1 (24/42) than male children 42.9 (18/42). This is shown in (Table 2).

Table 2 Demographics for WRA Aged 18-49 and Children Aged 6-23 Months

	Gwembe District % (*n*)	Siavonga District % (*n*)	Sinazongwe District % (*n*)	Total % (*N*)
Caregivers' district	33.3 (14)	33.3 (14)	33.3 (14)	100 (42)
Caregivers' mean age (SD), Range: 19-44 years	26.2 (5.8)	24.8 (5)	31.5 (6.7)	27.5 (6.4)
Children's mean age (SD), Range: 6-23 months	14.0 (5)	10.3 (3.5)	14.6 (5.3)	13.0 (4.9)
Male children	35.7 (5)	35.7 (5)	57.1 (8)	42.9 (18)
Female children	64.3 (9)	64.3 (9)	42.9 (6)	57.1 (24)

4.2. MOTHERS' COMFA+ TASTE-TEST RESULTS

4.2.1. ComFA+ Chibwabwa Fisashi

Overall, ComFA+Chibwabwa Fisashi was extremely liked by up to 95.2% (40/42) of the mothers. Aroma and flavor attributes were rated highly and equally, with up to 92.9% (39/42) of mothers extremely liking them. Following were appearance, mouth feel, and sweetnes, with up to 88.1% (37/42), 83.3% (35/42) and 75 (21/42) mothers extremely liking them, respectively. The least rated attribute was convenience with up to 73.8 (31/42) mothers (Table 3).

Table 3 Comfa+ Chibwabwa Fisashi: Mothers' Evaluation of Seven Attributes

Sensory attributes	Extremely liked % (*n*)	Liked % (*n*)	Neutral % (*n*)	Disliked % (*n*)	Extremely disliked % (*n*)
Aroma	92.9 (39)	4.8 (2)	0.0 (0)	0.0 (0)	2.4 (1)
Appearance	88.1 (37)	9.5 (4)	0.0 (0)	0.0 (0)	2.4 (1)
Mouth feel/texture	83.3 (35)	11.9 (5)	0.0 (0)	0.0 (0)	4.8 (2)
Flavor/taste	92.9 (39)	4.8 (2)	0.0 (0)	0.0 (0)	2.4 (1)
Sweetness	75 (21)	10.7 (3)	14.3 (4)	0.0 (0)	0.0 (0)

Averaged scores	86.4 (34)	8.3 (3)	14.3 (4)	0.0 (0)	12 (1)
Non-sensory attributes					
Convenience	73.8 (31)	19 (8)	4.8 (2)	2.4 (1)	0.0 (0)
Overall acceptability	95.2 (40)	4.8 (2)	0.0 (0)	0.0 (0)	0.0 (0)

4.2.2. ComFA+ Kapenta Chutney

Almost all the mothers [97.6% (41/42)] extremely liked ComFA+Kapenta Chutney. The flavor is what mothers [95.2% (40/42)] liked very much. The flavor was followed by mouth feel/texture, aroma, convenience and appearance, with up to 90.5% (38/42), 88.1% (37/42), 85.7% (36/42) and 78.6% (33/42) mothers liking the attributes very much respectively. Sweetness was the least rated attribute, with 45.2 (19/42) of the mothers extremely liking the sweetness in ComFA+Kapenta Chutney (Table 4).

Table 4 Comfa+ Kapenta Chutney: Mothers' Evaluation of Seven Attributes

Sensory attributes	**Extremely liked % (*n*)**	**Liked % (*n*)**	**Neutral % (*n*)**	**Disliked % (*n*)**	**Extremely disliked % (*n*)**
Aroma	88.1 (37)	9.5 (4)	2.4 (1)	0.0 (0)	0.0 (0)
Appearance	78.6 (33)	21.4 (9)	0.0 (0)	0.0 (0)	0.0 (0)
Mouth feel/texture	90.5 (38)	4.8 (2)	2.4 (1)	0.0 (0)	2.4 (1)
Flavor/taste	95.2 (40)	2.4 (1)	2.4 (1)	0.0 (0)	0.0 (0)
Sweetness	45.2 (19)	7.1 (3)	2.4 (1)	0.0 (0)	7.1 (3)
Averaged scores	79.5 (33.4)	9.0 (3.8)	1.9 (0.8)	0.0 (0)	1.9 (0.8)
Non-sensory attributes					
Convenience	85.7 (36)	7.1 (3)	4.8 (2)	0.0 (0)	2.4 (1)
Overall acceptability	97.6 (41)	2.4 (1)	0.0 (0)	0.0 (0)	0.0 (0)

4.2.3. ComFA+ Complementary Maize Porridge

Overall 66.7% (28/42) of the mothers liked ComFA+Complementary Maize Porridge very much. The first three highly rated attributes were Aroma, Appearance and Convenience, with mothers up to 69% (29/42), 69% (29/42) and 66.7% (28/42) extremely liking them, respectively. Mouth

feel, flavor, and sweetness were the least rated, with proportions of mothers being 59.5% (25/42), 54.8% (23/42) and 52.4% (22/42), respectively (Table 5).

Table 5 Comfa+ Maize Porridge: Mothers' Evaluation of Seven Attributes

Sensory attributes	Extremely liked % (*n*)	Liked % (*n*)	Neutral % (*n*)	Disliked % (*n*)	Extremely disliked % (*n*)
Aroma	69 (29)	19 (8)	2.4 (1)	0.0 (0)	4.8 (2)
Appearance	69 (29)	23.8 (10)	0.0 (0)	0.0 (0)	2.4 (1)
Mouth feel/texture	59.5 (25)	19.5 (8)	2.4 (1)	0.0 (0)	14.6 (6)
Flavor/taste	54.8 (23)	34.1 (14)	2.4 (1)	0.0 (0)	2.4 (1)
Sweetness	52.4 (22)	14.3 (6)	9.5 (4)	0.0 (0)	7.1 (3)
Averaged scores	60.9 (25.6)	22.6 (9.2)	3.3 (1.4)	0.0 (0)	6.3 (2.6)
Non-sensory attributes					
Convenience	66.7 (28)	23.8 (10)	0.0 (0)	0.0 (0)	2.4 (1)
Overall acceptability	66.7 (28)	21.4 (9)	2.4 (1)	2.4 (1)	4.8 (2)

4.2.4. ComFA+ Bean-Vegetable Soup

Slightly over half of the mothers 54.2% (13/24) extremely liked ComFA+Bean-Vegetable Soup. Convenience 62.5% (15/24), followed by mouth feel 54.2 (13/24), aroma 56% (14/24) and flavor 54.2% (13/24) as well as appearance 50% (12/24). The least liked attribute was sweetness with up to 37.5% (9/24) mothers reported extremely liking the attribute (Table 6).

Table 6 Comfa+ Bean-Vegetable Soup: Mothers' Evaluation of Seven Attributes

Sensory attributes	Extremely liked % (*n*)	Liked % (*n*)	Neutral % (*n*)	Disliked % (*n*)	Extremely disliked % (*n*)
Aroma	56 (14)	16 (4)	12 (3)	4 (1)	12 (3)
Appearance	50 (12)	14.3 (6)	20.8 (5)	0.0 (0)	4.2 (1)
Mouth feel/texture	54.2 (13)	16.7 (4)	16.7 (4)	0.0 (0)	12.5 (3)
Flavor/taste	54.2 (13)	20.8 (5)	12.5 (3)	4.2 (1)	8.3 (2)
Sweetness	37.5 (9)	13.3 (2)	6.7 (1)	6.7 (1)	13.3 (2)

Averaged scores	50.6 (12.2)	16.2 (4.2)	13.7 (3.2)	2.9 (0.6)	10 (2.2)
Non-sensory attributes					
Convenience	62.5 (15)	25 (6)	4.2 (1)	0.0 (0)	8.3 (2)
Overall acceptability	54.2 (13)	33.3 (8)	8.3 (2)	0.0 (0)	4.2 (1)

Figure 7 shows a significant difference in the overall acceptability of the four ComFA+foods (*p<0.001*). Mothers extremely liked ComFA+Kapenta Chutney, followed by ComFA+Chibwabwa Fisashi and ComFA+Maize Porridge. The difference was mainly explained by the least liked food, ComFA+Bean-Vegetable-Soup.

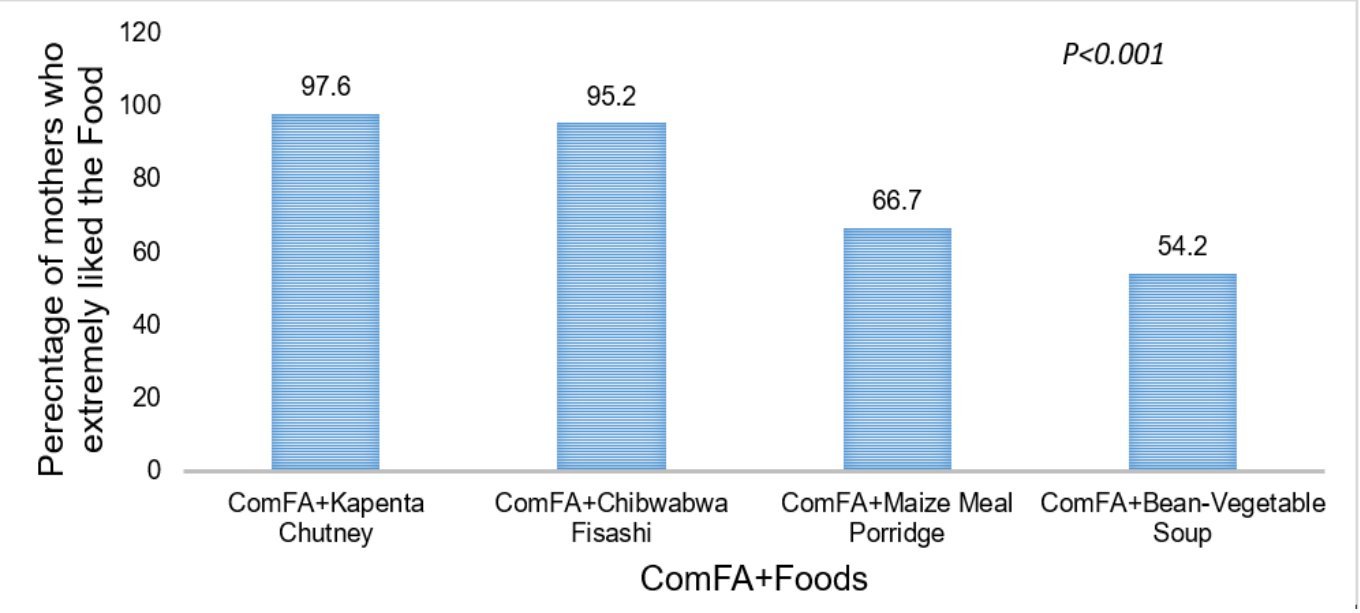

Figure 7 Test of Difference between Comfa+Fortified Traditional Dishes

4.3. SENSORY TRIAL II RESULTS – CHILDREN'S TASTE-TEST

Up to 42 children aged 6-23 months participated in the ComFA+Maize porridge taste-test study. Among them were children aged 6-11 months 38.1 %(16/42) and children aged 12-23 months 61.9 %(26/42). Figure 8 shows some of the children.

Figure 8 Infants' Comfa+ Taste-Test

4.3.1. ComFA+ Complementary Maize Porridge results among 6-11 month-olds

Most children aged 6-11 months 87.5 %(14/16) extremely liked the ComFA+ maize porridge at time 1 (T1) and at time 2 (T2). At time 3 (T3), up to 81.2 %(13/16) children extremely liked the ComFA+ Maize porridge. An entire portion, ¾ and ½ portions were consumed by 37.5 %(6/16), 31.3 %(5/16) and 31.3 %(5/16) respectively at T1+T2+T3. Slightly over half, 56.3 %(9/16) of the children consumed their regular amount, while up to 31.3 %(5/16) children consumed half of their regular amount at T1+T2+T3. Most of the children, 81.2 %(13/16), consumed one serving at T1+T2+T3. The details are shown in table 7.

Table 7 Comfa+ Complementary Maize Porridge Taste-Test Results among 6-11 Month-Olds

Child's global liking:	**Extremely liked % (*n*)**	**Liked % (*n*)**	**Neutral % (*n*)**	**Disliked % (*n*)**	**Extremely disliked % (*n*)**
T1	87.5 (14)	12.5 (2)	—	—	—
T2	87.5 (14)	12.5 (2)	—	—	—
T3	81.2 (13)	12.5 (2)	—	—	6.3 (1)
Child's actual consumption:	Consumed entire portion % (*n*)	Consumed 3/4 portion % (*n*)	Consumed 1/2 portion % (*n*)	Consumed 1/4 portion % (*n*)	Consumed <1/4 portion % (*n*)
T1+T2+T3	37.5 (6)	31.3 (5)	31.3 (5)	—	—

Child's relative consumption:	Consumed their regular amount % (*n*)	Consumed 3/4 of their regular amount % (*n*)	Consumed 1/2 of their regular amount % (*n*)	Consumed 1/4 of their regular amount % (*n*)	Consumed <1/4 of their regular amount % (*n*)
T1+T2+T3 vs. child's regular intake	56.3 (9)	12.5 (2)	31.3 (5)	—	—
Full portions child consumed:	Consumed 3 full portions % (*n*)	Consumed 2 full portions % (*n*)	Consumed 1.5 full portions % (*n*)	Consumed 1 full portion % (*n*)	Consumed 1/2 portion % (*n*)

4.3.2. ComFA+ Complementary Maize Porridge results among 12-23 month-olds

Up to 88.5 (23/26) of children liked the porridge at time 3 (T3). In addition, up to 80.7% (21/26) consumed the entire portion at T1+T2+T3. Furthermore, up to 88.5 (23/26) consumed their regular amount. Half of the children aged 12-23 months, 50% (13/26), consumed one serving, while 42.3% (11/26) consumed two servings of ComFA+ Complementary Maize Porridge (Table 8).

Table 8 Comfa+ Maize Porridge Taste-Test Results among children aged 12-23 Months

Child's global liking:	**Extremely liked % (*n*)**	**Liked % (*n*)**	**Neutral % (*n*)**	**Disliked % (*n*)**	**Extremely disliked % (*n*)**
T1	84.6 (22)	7.7 (2)	—	—	7.7 (2)
T2	88.5 (23)	3.8 (1)	—	—	7.7 (2)
T3	88.5 (23)	3.8 (1)	—	—	7.7 (2)
Child's actual consumption:	Consumed entire portion % (*n*)	Consumed 3/4 portion % (*n*)	Consumed 1/2 portion % (*n*)	Consumed 1/4 portion % (*n*)	Consumed <1/4 portion % (*n*)
T1+T2+T3	80.7 (21)	3.8 (1)	3.8 (1)	7.7 (2)	3.8 (1)
Child's relative consumption:	Consumed their regular amount % (*n*)	Consumed 3/4 of their regular amount % (*n*)	Consumed 1/2 of their regular amount	Consumed 1/4 of their regular amount	Consumed <1/4 of their regular amount % (*n*)

			% (*n*)	% (*n*)	
T1+T2+T3 vs. child's regular intake	88.5 (23)	7.7 (2)	—	—	3.8 (1)
Full portions child consumed:	Consumed 3 full portions % (*n*)	Consumed 2 full portions % (*n*)	Consumed 1.5 full portions % (*n*)	Consumed 1 full portion % (*n*)	Consumed 1/2 portion % (*n*)
T1+T2+T3+ addtl. Portions	3.9 (1)	42.3 (11)	3.9 (1)	50 (13)	—

In table 9, overall, children aged 6-23 months extremely liked the ComFA+Maize Porridge. However, it is noteworthy that children aged 12-23 had better consumption patterns for ComFA+Maize Porridge. At Time 3 (T3), 88.5% of the children aged 12-23 months extremely liked the ComFA+ Maize porridge, with 80.7% having consumed the entire portion, 88.5% consumed their regular amount while 42.3% consumed up to 2 servings. On the other hand, only up to 81.2% of the children aged 6-11 months extremely liked the porridge by Time 3 (T3), with 37.5% who consumed the entire portion, while 56.3% consumed their regular amount. In addition, children aged 6-11months who consumed up to 2 servings were only 6.3% (Table 9).

Table 9 Comfa+ Complementary Maize Porridge Outstanding Eating Behaviors

N=26	**6-11 Months, n=16**	**12-23 months, n=26**
Extremely liked the ComFA+ maize porridge		
Time 1 (T1)	87.5 (14)	84.6 (22)
Time 2 (T2)	87.5 (14)	88.5 (23)
Time 3 (T3)	81.2 (13)	88.5 (23)
Child's actual porridge intake: T1+T2+T3	Ate entire portion % (n) 37.5 (6)	Ate entire portion % (n) 80.7 (21)

Child's relative porridge intake: T1+T2+T3 versus child's regular intake	Ate their regular amount % (n) 56.3 (9)	Ate their regular amount % (n) 88.5 (23)
Total number of servings child ate: T1+T2+T3+addtl. Servings	2 servings % (n) 6.3 (1)	2 servings % (n) 42.3 (11)

5.0 DISCUSSION

Main findings: Mothers' ComFA+ Taste-Test overall acceptability results showed that ComFA+Kapenta was extremely liked by almost all the mothers followed by ComFA+Chibwabwa Fisashi and ComFA+maize porridge. ComFA+Bean-Vegetable Soup was the least liked dish. There was a significant difference *(p<0.001)* in terms of the overall acceptability ComFA+ dishes. ComFA+Bean-Vegetable Soup mainly explained the differences. The mothers suggested that ComFA+Bean-Vegetable soup could equally be a good dish if the composition of specific ingredients, such as sugar and salt, could be adjusted to taste better. It should also be noted here that there were fewer mothers, with only 57.1% who handed in the taste-test forms for ComFA+Bean-Vegetable soup. The lower evaluation forms for the ComFA+Bean-Vegetable soup compared to other ComFA+ foods could have influenced the results. However, elsewhere taste perception and taste sensitivity have been reported to vary with many factors, including age, nutritional knowledge, attitude, and social, economic and cultural factors (Drewnowski, 1997, Ozilgen, 2012). Food preference can affect adherence to ComFA+fortified traditional foods. Good adherence is a primary determinant of the effectiveness of an intervention (Lester et al., 2022).

The Sensory Trial II– Children's Taste-Test study revealed that more children aged 12-23 months participated in the study than their counterparts aged 6-11 months. Overall, children aged 6-23 months all liked the ComFA+Maize Porridge. However, it is noteworthy that children aged 12-23 had better consumption patterns for ComFA+Maize Porridge than children aged 6-11 months. By Time 3 (T3), 88.5% of the children aged 12-23 months extremely liked the ComFA+ Maize porridge compared to 81.2% of the children aged 6-11 months. Children 12-23 months who ate the entire portion at T1+T2+T3 were 80.7%, while those aged 6-11 months were 37.5%. Children aged 12-23 months, up to 88.5%, ate their regular amount at T1+T2+T3 compared to 56.3% of children aged 6-11 months. Lastly, children aged 12-23 months up to

42.3% ate up to 2 servings, while children aged 6-11months who ate up to 2 servings were only 6.3% at T1+T2+T3. Most of the children (81.2%) aged 6-11 months only ate one serving.

The study has also revealed that the taste preferences and quantity consumed among children aged 6-23 months are influenced by age in consonant with studies elsewhere (Drewnowski, 1997, Lester et al., 2022). This study is also in tandem with WHO age-appropriate complementary feeding guidelines (WHO, 2010). FishFirst! Zambia: Research for Development and Scaling Staple-Fish Products for Enhanced Nutrition in the First 1,000 Days of Life strategies should take care of age-appropriate feeding of children aged 6-23 months.

Novelty: To the best of our knowledge, this is the first taste-test study using fish powder carried out in the lake Kariba Catchment area in the Southern Province of Zambia.

Limitations: Out of all the mothers that rated ComFA+Traditional dishes, only half of them showed that they extremely liked Bean-Vegetable soup. Meanwhile, only up to 26 mothers out of 42 submitted taste-test forms for ComFA+Bean-Vegetable soup. Missing data on ComFA+Bean-Vegetable soup could have affected the results. Ensuring all the mothers submit the forms could improve future study outcomes on all taste-test dishes.

Conclusion: Mothers' ComFA+ Taste-Test overall acceptability results showed that ComFA+Kapenta was extremely liked by almost all the mothers, followed by ComFA+Chibwabwa Fisashi and ComFA+maize porridge. Few mothers submitted taste-test forms for ComFA+Bean-Vegetable Soup, the least liked food. Age, nutritional knowledge, attitude, social, economic and culture are some of the factors that can affect taste preferences. The Sensory Trial II– Children's Taste-Test study showed that children aged 6-23 months generally liked the ComFA+Maize Porridge. The study has also revealed that the taste preferences and quantity consumed are influenced by age

Recommendations: Ensuring that all mothers fill in and submit taste forms could improve future taste-test results in all dishes. In addition, the intervention strategies for the FishFirst! Zambia: Research for Development and Scaling Staple-Fish Products for Enhanced Nutrition in the First 1,000 Days of Life should consider sensory pleasure response to foods and demographic and sociocultural variables. The research should also take care of age-appropriate feeding of children aged 6-23 months.

6.0 REFERENCES

Citypopulation. ZAMBIA: Administrative Division. Provinces and Districts. https://citypopulation.de/en/zambia/admin/ (2016).

CSO. GOVERNMENT OF ZAMBIA Zambia Demographic and Health Survey 2018. 1–581 (2020).

Daelmans, B., Dewey, K. & Arimond, M. New and updated indicators for assessing infant and young child feeding. *Food Nutr. Bull.* **30**, 256–262 (2009).

Drewnowski, A. Taste preferences and food intake. *Annu Rev Nutr.* **17.1**, 237 (1997).

FAO. Report adopted on 1 December 2004 in Kariba, Zimbabwe, by the second Technical Consultation on the Development and Management of the Fisheries of Lake Kariba. (2004).

Gennari, P., Heyman, A. & Kainu, M. FAO statistical pocketbook. World food and agriculture. *Food Agric. Organ. United Nations, Rome, Italy* (2015)

Hannah Ritchie and Max Roser. 'Micronutrient Deficiency'. Published online at OurWorldInData.org. (2017).

Indikit. Egg and/or Flesh Food Consumption by Children. https://www.indikit.net/indicator/4451-egg-and-or-flesh-food-consumption-by-children-aged-6-23-months#.

Jaffe, T., Wang, H. & Chambers, E. Determination of a lexicon for the sensory flavor attributes of smoked food products. *J. Sens. Stud.* **32**, e12262 (2017).

Joordens, J. C. A., Kuipers, R. S., Wanink, J. H. & Muskiet, F. A. J. A fish is not a fish: Patterns in fatty acid composition of aquatic UNICEF & GSO. Viet Nam Multiple Indicator Cluster Survey 2014. 93 (2015).

Lester, S. *et al.* Factors Affecting Adherence, Intake, and Perceived Palatability of Oral Nutritional Supplements: A Literature Review. **26**, 663–674 (2022).

Ozilgen, S. Factors affecting taste perception and food choice. *Sense Tast.* 115–125 (2012).

Parmar, P., Rathod, G., Rathod, S. & Parikh, A. Consent in medical practice Perceptions of patients towards legal aspects of informed consent. *Iaim* **3**, 105–110 (2016).

Sargentl, J. R. & Tacon, A. G. J. Development of farmed fish : a nutritionally necessary alternative to meat. **44**, 377–383 (1999).

Shaviklo, A. R. Development of fish protein powder as an ingredient for food applications : a review. **52**, 648–661 (2015).

Tacon, A. G. J. & Metian, M. Reviews in Fisheries Science & Aquaculture Food Matters : Fish, Income, and Food Supply — A Comparative Analysis. *Rev. Fish. Sci. Aquac.* **0**, 1–14 (2017).

UNICEF. UNICEF Data: Monitoring the situation of children and women. https://data.unicef.org/topic/nutrition/diets/ (2021).

.WHO. GUIDING PRINCIPLES FOR FEEDING NON-BREASTFED CHILDREN 6-24 MONTHS OF AGE (2010).

WHO. *Global Nutrition Report*. *Global Nutrition Report* (2018).

WHO. Fact sheets, malnutrition. https://www.who.int/news-room/fact-sheets/detail/malnutrition (2021).

7.0 ANNEXES

ANNEX 1 INFORMED CONSENT FORM

Mississippi State University

Informed Consent Form for Participation in Research
IRB Approval Number: 22-206
Title of Research Study: FishFirst! Zambia: Research for Development and Scaling Staple-Fish Products for Enhanced Nutrition in the First 1,000 Days of Life
Study Site: Zambia
Researchers: Dr. Kathleen Ragsdale, Mississippi State UniversityPurpose
The purpose of the research study was to conduct a taste-test among mothers and their infants to learn whether they find a food tasty and acceptable. This food was called Complementary Food for Africa+Dried Fish Powder – or ComFA+ for short – and it was added to traditional maize porridge to increase its nutrition for infants and young children. The ingredients of ComFA+ were locally sourced dried fish powder, groundnut powder, orange-fleshed sweet potato, and vegetable oil, cooked in water. ComFA+ may contain peanut/nut oil. A taste-test among mother'sages 18-49 years and their infant's ages 6-23 months of traditional maize porridge to which ComFA+ was added were conducted.
Procedures
If the mother and the child participated in this taste-test, they were first asked to taste a small portion of traditional maize porridge to which ComFA+ was added and told us what they thought of its tasteand other characteristics using the Mothers' Acceptability Scale that was provided. Next, they were asked to feed the child a small portion of traditional maize porridge to which ComFA+ was added and told us whether the child likes or dislikes the porridge, using the Infants' Acceptability Scale for Mothers that was provide. The taste-test took about 2 hours.
Risks or Discomforts
Although the study involved no more than minimal risk to participants, such that people may encounter in their day-to-day lives, participation required eating a food, and that presents potential risks of choking, allergic reactions, or other adverse or unanticipated events. This food was called Complementary Food for Africa+Dried Fish Powder – or ComFA+ for short – and it was addedto traditional maize porridge to increase its nutrition for infants and young children. The ingredientsof ComFA+ are locally sourced dried fish powder, groundnut powder, orange-fleshed sweet potato, and vegetable oil, cooked in water. The mother and the child was asked to eat a portion of traditional maize porridge to which ComFA+ was added. Although all ingredients are locally sourced, if the mother or the child have any known allergy to these foods, the mother and/or the child could not participate in the study. The ComFA+ contained peanut/nut oil. If the mother or the child has never eaten maize porridge, not allowed to participate in the study. If the mother or the child has never eaten any fish or fish-based foods, they were not allowed to participate in the study.

Benefits

The mother and the child were not directly benefiting from participation in the taste-test, although others benefited if ComFA+ is found to be an acceptable food to add to traditional maize porridge toincrease its nutrition for infants and young children.

Incentive to participate

There were no incentives for mothers or child's participation.

Confidentiality

Because our funder, the USAID, required documented research activities and produce research-related media, photographs and videotape (with audio) during the taste-test for Posting on sites such as USAID's Feed the Future were taken. These photos or videos were used when sharing the results of this study with the funders or other researchers when presenting the results atmeetings or during educational webinars.

Do you grant permission to be photographed? Please check YES or NO: …..YESNO Do you ☐ ☐ grantpermission to be videotaped? Please check YES or NO YES NO ☐ ☐

Please note that these records were held by a state entity and therefore are subject to disclosureif required by law. Research information may be shared with the MSU Institutional Review Board (IRB) and the Office for Human Research Protections (OHRP) and others who are responsible for ensuring compliance with laws and regulations related to research, including people on behalf of USAID. The information from the research was published for scientific purposes; however, the identity were not given out. The sponsor of the study, USAID, had access to the records of the research.

Questions

If you have any questions about this research project or want to provide input, please feel free tocontact Dr. Kathleen Ragsdale at +1 662-325-9168. For questions regarding your rights as a research participant or to request information, please feel free to contact the MSU Human Research Protection Program (HRPP) by e-mail at irb@research.msstate.edu, or visit our participant page on the website at https://www.orc.msstate.edu/human-subjects/participant-information. To report problems, concerns, or complaints pertaining to your involvement in this research study, you may do so anonymously by contacting the MSU Ethics Line at http://www.msstate.ethicspoint.com/.

Research-related injuries

MSU and USAID had not provided for any payment to anyone's treatment if they are harmed as a result of taking part in the study. In addition to reporting an injury to Dr. Kathleen Ragsdale at

+1 662- 325-9168 and to the Research Compliance & Security Office at +1 662-325-5220, they were able to obtain limited compensation from the State of Mississippi if the injury was caused by the negligent act of a state employee where the damage was a result of an act for which payment may be made under §11- 46-1, et seq. Mississippi Code Annotated 1972. A claim form was obtained through contacting the University Police Department at *MSU UNIVERSITY POLICE DEPARTMENT, Williams Building, Mississippi State, MS 39762, and +1 662-325-2121.*

Voluntary Participation

Please understand that participation was voluntary. To those who refused to participate no penalty or loss of benefits to which they were entitled was involved. Discontinuation of participation was allowed at any time without penalty or loss of benefits.

Please take all the time you need to read through this document and decide whether you would like to participate in
This research study.

Participant Signature

Date

Investigator Signature

Date

_____ _____

_____ _____

Research Participant Satisfaction Survey
To make sure that your rights as a research participant have been protected,

Participation in the research study, the MSU HRPP would like for you to complete this survey.This will help us make sure that research participants are protected. https://msstate.co1.qualtrics.com/jfe/form/SV_5dMg4uHnw8tU5D0

ANNEX 2 INFORMED ASSENT FORM

Mississippi State University
Parental or Legally Authorized Representative Permission Form for Participation in Research

They were asked to allow their child to participate in a research project. This form provided information about the project. Please read the information below and ask any questions you might have before deciding whether or not to allow your child to participate.
IRB Approval Number: 22-206
Title of research project: FishFirst! Zambia: Research for Development and Scaling Staple-FishProducts for Enhanced Nutrition in the First 1,000 Days of Life
Site of research project: Zambia
Name of researcher(s): Dr. Kathleen Ragsdale, Mississippi State UniversityThe purpose of the research project:
The purpose of the research study was to conduct a taste-test among mothers and their infants to learn whether they find a food tasty and acceptable. This food was called

Complementary Food forAfrica+Dried Fish Powder (ComFA+). It was added to traditional maize porridge to increase its nutrition for infants and young children. The ingredients of ComFA+ were locally sourced dried fishpowder, groundnut powder, orange-fleshed sweet potato, and vegetable oil, cooked in water.
ComFA+ contained peanut/nut oil. A taste-test was conducted among mothers (18-49 years) and their infants (6-23 months) of traditional maize porridge to which ComFA+ was added.
If the mother agree to allow their child to take part in the research project, the child was asked to dothe following things:
During the taste-test, the mother was asked to feed the child a small portion of traditional maizeporridge to which ComFA+ was added and told us whether the child liked ordisliked the porridge, using the Infants' Acceptability Scale for Mothers provided.
The total estimated time to participate in this research project was 2 hours.
The risks of participation:
Although the study involved no more than minimal risk to participants, such that people could encounter in their day-to-day lives, participation required eating a food, and that presents potential risks of choking, allergic reactions, or other adverse or unanticipated events. This food was called Complementary Food for Africa+Dried Fish Powder (or ComFA+) and it was added to traditional maize porridge to increase its nutrition. The ingredients of ComFA+ were locally sourced dried fish powder, groundnut powder, orange-fleshed sweet potato, and vegetable oil, cooked in water. The mother and the child were asked to eat a portion of traditional maize porridge to which ComFA+ was added. Although all ingredients were locally sourced, if the mother or the child have any known allergy to these foods, they were not allowed to participate in the study. The ComFA+ contained peanut/nut oil. If the mother or the child had never eaten maize porridge, they were not allowed to participate in the study. If the mother or the child had never eaten any fish or fish-based foods, they were not allowed to participate in the study.
If the child was injured as a result of participating in the research the mother should know the following:
In addition to reporting an injury to Dr. Kathleen Ragsdale (+1 662-325-9168) and the MSU Research Compliance & Security Office (+1 662-325-5220), the mother would be able to obtain limited compensation from the State of Mississippi if the injury was caused by the negligent act of a stateemployee where the damage was a result of an act for which payment would be made under §11-46-1, et seq. Mississippi Code Annotated 1972. To obtain a claim form, contact the MSU Police Department (+1 662-325-2121).
The benefits of participation:
The mother and the child would not directly benefit from participation in the taste-test, although others would benefit from the scaling of ComFA+ for distribution to vulnerable households that routinely lack adequate nutrition, particularly for women and for children ages 6-23 months.
Compensation:
There were no incentives for the child's participation.Confidentiality and privacy protections:
Because the funder, was USAID, required documented research activities and produce research-related media, photographs and videotape(with audio) were taken during the taste-test for posting on sites such as USAID Feed the Future. We used these photos or videos when sharing the results of the study with the funders or other researchers when presenting the results at meetings or during educational webinars ☐ ☐
Do you grant permission to have your child photographed? YES NODo you grant permission to have your child videotaped? YES NO ☐ ☐

It is important to understand that these records will be held by a state entity andtherefore are subject to disclosure if required by law and that the participants' information will remain confidential.

Contacts and questions:
If you have any questions, please ask now. If you should have any questions later orwant additional information, please contact Dr. Kathleen Ragsdale at +1 662-325- 9618. For information regarding your rights as a research subject, please contact theMSU Research Compliance & Security Office at
+1 662-325-5220.
If the mother do not want the child to participate:
They should understand that the child's participation is voluntary. There were no penaltyor loss of benefits to which the mother or the child was otherwise entitled if the mother choose not to let their child participate. The mother was allowed to discontinue the child's participation at any time without penalty or loss of benefits. The mother's refusal to have their child participating did not impact current or future relationships with Mississippi State University. To do so, they simply told the researcher that they wish to stop the child from participating.
If after reading the information above, the mother agreed to allow the child to participate,they signed below. If the mother decide later that they wish to withdraw the permission, they simply told the researcher. Discontinuation of participation was allowed at any time. A copy of this form was given for records.

_____
Child's name (please print)

_____ _____
Parent's Signature Date

_____ _____
Parent's Signature (if applicable) Date

_____ _____
Investigator's Signature Date

Research Participant Satisfaction Survey. To make sure that your rights as a research participant have been protected, after your participation in the research study, the MSU HRPP would like for you to complete this survey. Your answers will help us make sure that research participants are protected. https://msstate.co1.qualtrics.com/jfe/form/SV_5dMg4uHnw8tU5D0

ANNEX 3 ELIGIBILITY CRITERIA

FishFirst! Zambia: Taste-Test among Mother–Infant PairsRECRUITMENT SCRIPT
Thank you for the opportunity to speak with you. We are a study team from Mississippi State University. We are conducting a taste-test among mothers and their infants to learn whether they find a food tasty. This food is calledComplementary Food for Africa+Dried Fish Powder –

or ComFA+ for short – and it is added to traditional maize porridge to increase its nutrition for infants and young children. The ingredients of ComFA+ are locally sourced and include dried fish powder, groundnut powder, orange-fleshed sweet potato, and vegetable oil, cooked in water. ComFA+ may contain peanut/nut oil. We will conduct a taste-test among mothers' ages 18-49 years and their infants' ages 6-23 months of traditional maize porridge to which ComFA+ has been added.

If you are willing to have you and your child take part in the taste-test, we will first ask you to taste a small portionof traditional maize porridge to which ComFA+ has been added. We will ask you questions about the porridge's aroma, appearance, texture, taste, sweetness, convenience, and overall acceptability. Next, we will ask you to feed your child a small portion of the porridge and tell us whether your child liked or dislike the porridge. The taste-test will take about two hour to complete.

Your answers are confidential. This means we will not ask you for your name and your answers are private and any information that can identify you will not be shared outside the study team. The information you provide maybe used to develop programs that could help people in this area. Your participation is entirely voluntary – this means you can stop participating at any time or skip any questions you do not want to answer.

Q1. Would you like to take the ELIGIBILITY SCREEN? 1 = No [GO TO Q2]

2 = Yes [GO TO ELIGIBILITY SCREEN]

Q2. Could you tell me why you declined the eligibility screen? 1 = don't have the time.

2 = Topic doesn't interest me.

3 = Other:___

ELIGIBILITY SCREEN

The ingredients of ComFA+ are locally sourced dried fish powder, groundnut powder, orange-fleshed sweetpotato, and vegetable oil, cooked in water. ComFA+ may contain peanut/nut oil. Although all ingredients arelocally sourced, if you or your child have any known allergy to these foods, you and your child should not participate in the study. If your child has not consumed any fish-based foods in the past, they should not participate. If your child has not previously eaten porridge, they should not participate.

Do you have any known allergy to dried fish powder, groundnut powder, orange-fleshed sweet potato,peanut/nut oil, or vegetable oil? 1 = No

2 = Yes [END SCREENING]

Does your child have any known allergy to dried fish powder, groundnut powder, orange-fleshed sweetpotato, peanut/nut oil, or vegetable oil? 1 = No

2 = Yes [END SCREENING]

Has your child eaten any kind of fish or fish-based foods before today? …… 1 = No [END SCREENING]

2 = Yes

Has your child eaten maize porridge before today? 1 = No [END SCREENING]

2 = Yes

How old is your child? AGE:_MONTHS

[Not 6-23 months [END SCREENING]

Is your child (select one) 1 = MALE

2 = FEMALE

How old are you? AGE:_YEARS

[Not 18-49 years [END SCREENING]

Are you from (select one) 1 = GWEMBE

2 = SIAVONGA
3 = SINAZONGWE
You and your child are eligible to participant. Would you like to continue with informed consent and parentalpermission for you and your child to participate? 1 = No [END SCREENING]
2 = Yes
Thank you. I'll now take you through the informed consent and parental permission process.
Taste-Test - Recruitment & Eligibility Screen: Page 1 of 1

ANNEX 4 MOTHERS' ACCEPTABILITY SCALE (SCALE 1)

FishFirst! Zambia: Taste-Test Among Mother–Infant PairsTaste-Test: Part 1 - Mothers' Acceptability Scale (Scale 1)

1 = MALE

How well do you like the aroma / smell of the food? (AROMA / SMELL)

Mother's Age:…..YEARS
Child age/sex
District:
1 = GWEMBE
2 = SIAVONGA
3 = SINAZONG

How well do you like the appearance of the food? (APPEARANCE)

How well do you like the way the food feels in your mouth? (MOUTH FEEL /TEXTURE)

How well do you like the flavor / taste of the food? (FLAVOR / TASTE)

How well do you like the sweetness of the food? (SWEETNESS)

How well do you like or dislike how easy food will be to use in achild's meal at least once per day? (CONVENIENCE)

Overall, how well do you like the food? (OVERALL ACCEPTIBILITY)

LEGEND

1	2	3	4	5
Dislikes very	Dislikes	Neither likes nor dislikes	Likes	Likes very

ANNEX 5 INFANTS' ACCEPTABILITY SCALE FOR MOTHERS (SCALE 2)

FishFirst! Zambia: Taste-Test among Mother–Infant Pairs Taste-Test: Part 2 - Infants' Acceptability Scale for Mothers

Mother's Age:…..YEARS
Child age/sex
District:
1 = GWEMBE
2 = SIAVONGA
3 = SINAZONGWE

(Scale 2)

GLOBAL LIKING – 5-POINT SUBSCALE: Time 1-Time 3

Mother's comments to describe feeding situation (e.g., child wasbreastfed right before taste-test, child was tired, etc.):

_____

_____

_____

ANNEX 6 TECHNICAL & SIMPLIFIED LEXICON & SCALE DESCRIPTORS

TECHNICAL & SIMPLIFIED LEXICON: Scale 1

Table 1. Mothers' Acceptability Scale" (Scale 1): Taste-Test Lexicon of Technical and Simplified Definitions to Assess Sample Attributes

Descriptor	Technical Definition	Simplified Definition	Scoring
1.Aroma / Smell	Distinct aromatic notes associated with the sample	Distinct aroma / smell of the food	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much
2.Appearance	Color: Description of predominant color of the sample and its relative intensity	Main color of the food	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much
3.Texture / Mouth Feel	Smoothness: Geometrical attribute associated with the overall degree of absence of particles within the sample	Overall smoothness of the food and lack of any grainy texture or particles	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much
4.Flavor /Taste	Flavor notes associated withthe sample	Distinct flavor / taste of the food	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much
5.Sweetness	Gustatory sensation that remains after swallowing that is associated with sample's overall sweetness as compared	Lingering taste after swallowing food that is similar to the sweet taste of boiled sweet potato	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much

	to boiled sweet potato		
6.Convenience	How well you like or dislike how easy it will be to use at least once per day in a complementary meal for 6-23 month-olds	How well you like or dislike how easy it will be to use at least once per day in a meal for your 6-23 month-Old	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much
7.Overall Acceptability	How well you like or dislike the sample when you consider its smell, appearance, texture, flavor, sweetness, and how convenient it will be to use at least once per day in a meal for 6-23 month-olds	How well you like or dislike the food's smell, appearance, texture, flavor, sweetness, and how easyit will be to use at least once per day in a meal for your 6-23 month-old	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much

ANNEX 7 SIMPLIFIED LEXICON: SCALE 1

Table 2. Taste-Test Lexicon Chart with Simplified Definitions to Assess Sample Attributes for use with Mothers' Acceptability Scale (Scale 1)

Descriptor	Simplified Definition	Scoring
1.Aroma / Smell	Distinct aroma / smell of the food	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much
2.Appearance	Main color of the food	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much
3.Texture / Mouth Feel	Overall smoothness of the food and lack of any grainytexture or particles	1=Dislikes very much 2=Dislikes 3=Neither likes nor dislikes 4=Likes 5= Likes very much

ANNEX 8 PROGRAMME FOR FISHFIRST! ZAMBIA

FishFirst! Zambia: 12 JUN – 26 JUN 2022						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
5 Jun	**6 Jun**	**7 Jun**	**8 Jun**	**9 Jun**	**10 Jun**	**11 Jun**
12 Jun **GTR–ATL: DL4972** **12:15pm:** **Depart GTR 2:25pm: Arrive ATL** **ATL–JNB: DL200** **7:25pm:** **Depart ATL** **4:55pm:** **Arrive JNB** **on June 13**	**13 Jun** Joberg: PremierHotel OR Tambo, 73 Gladiator Street Rhodesfield, Kempton Park 1619 South Africa **ATL–JNB: DL200** **4:55pm: Arrive JNB**	**14 Jun** Lusaka: Hotel Protea @ Arcades (near WF HQ) **JNB–LUN: SA 62** **10:30am: Depart JNB** **12:25pm: Arrive LUN**	**15 Jun** Lusaka: Hotel Protea@ Arcades (near WF HQ) **WORLDFISH** **12:00-17:00** **Netsayi & Lizzy:** Train MSU, KK, AC on conducting Taste-Test Panel	**16 Jun** Lusaka: Hotel Protea @ Arcades **WORLDFISH** **9:00-17:00** MSU, WF: Finalize prep forComFA+ Taste- Test, Nutrition Training, ComFA+ Discussion Group, ComFA+ Training	**17 Jun** Lusaka: Hotel Protea @ Arcades **WORLDFISH** **9:00-17:00** MSU, WF: Finalize prep forComFA+ Taste- Test, Nutrition Training, etc.	**18 Jun** Lusaka: Hotel Protea @ Arcades (near WF HQ) Rest day for MSU team

19 Jun	20 Jun	21 Jun	22 Jun	23 Jun	24 Jun	25 June
TEAM: Lake Kariba Inn **SIAVONGA** **10:00-13:00 Lusaka*to Siavonga** (*WF will pick up MSU at HotelProtea-Arcades,near WF HQ) **13:00-14:00 Team Lunch & Logistics Mtg**	TEAM: Lake Kariba Inn PPTS: Freshview Hotel **SIAVONGA** **TBD* (N=5) Courtesy Calls to Govt Offices: (Siavonga)** 3 MSU **(Kathleen, Robert, Ania)** 2 WF **(Netsayi, Lizzy)** **(*Time to be advisedby govt protocol officers)** **~13:00 (N~56) participants (PPTs) from Gwembe and Sinazongwe (but not Siavonga-based participants?) check-inat Lake Safari Lodge**	TEAM: Lake Kariba Inn PPTS: Freshview Hotel TRAINING: Indaba Pub & Grill **SIAVONGA** **9:00-11:00 (N=60) Session 1: Nutrition Training** 1 DoF Officer **(Siavonga)** 3 DoH Officers **(Gwembe, Siavonga, Sinazongwe)** 3 Comm. Health Workers **(Gwembe, Siavon, Sinaz)** 3 Entrepreneurs **(Gwembe, Siavonga, Sinazongw)** 50 Mothers **(Gwembe, Siavonga, Sinazongwe)** **11:00-13:00 (N=60) Session 2: Discussion Group** Explore Nutrient-Dense Foods & Seasonality for ComFA+ Products **13:00-14:00 (N=60) Lunch** **14:30-16:30 (N=60) Session 3: ComFA+Training** Cooking Demonstration & Making ComFA+ Products	TEAM: Lake Kariba Inn PPTS: Freshview Hotel TRAINING: Indaba Pub & Grill **SIAVONGA** **9:00-12:00 (N=50+IYC) Session 4: ComFA+ Taste-Test** 50 Mothers + IYC **(Gwembe, Siavonga, Sinazongwe)** **12:00-13:00 (N=50+IYC) Lunch – ComFA+ Dishes** Siavonga-based participants depart from Lake Safari Lodge **14:00-16:00 Lake Kariba Inn - Team Debrief**	Lusaka: Hotel Protea @ Arcades **LUSAKA** **10:00-12:00 Lake KaribaInn - Team Prep for USAID Mission visit** **12:00-13:00 Lunch** **13:00-16:00 Siavonga to Lusaka**	Lusaka: Hotel Protea @ Arcades **LUSAKA** **9:00-10:00 USAID Mission**: MSU, Netsayi, Lizzy, Victor Siamudaala **12:00-17:00 WORLDFISH** Drafting trip report; Discussion of manuscripts based on the WEFI results, etc.	**LUN–JNB:SA 63** **1:05pm: Depart LUN** **3:05pm: Arrive JNB** **JNB–ATL: DL 201** **9:55pm: Depart JNB8am: ArriveATL** on June26

FishFirst! Zambia: 12 JUN – 26 JUN 2022

Sun	Mon	Tue	Wed	Thu	Fri	Sat

26 Jun	27 Jun	28 Jun	29 Jun	30 Jun	1 Jul	2 Jul
ATL – **GTR:** **DL4972** **11:27pm:** **Depart ATL** **11:34pm:** **Arrive GTR**						

About WorldFish

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world. Headquartered in Penang, Malaysia and with regional offices across Africa, Asia and the Pacific, WorldFish is a member of CGIAR, the world's largest global partnership on agriculture research and innovation for a food secure future.

For more information, please visit www.worldfishcenter.org