

FINAL REPORT ON THE ACCEPTABILITY TRIALS OF RICE FORTIFICATION IN DILI MUNICIPALITY -TIMOR -LESTE

Acceptability Trial 19th August to 12th September 2019

BACKGROUNDS

The activity of acceptability trials on fortified rice will contribute towards the achievement of national targets for improving nutrition and access to adequate, nutritious and affordable food all year round, as stated in the national Zero Hunger Challenge plan of action, National Nutrition Strategy and Food and Nutrition Security Policy. The overarching goal is hunger and malnutrition-free Timor-Leste by 2025, contributing to the achievement of SDG target 2.2 by 2030.

Food fortification is considered the most cost-effective way to improve nutrition especially when it comes to fortified rice in the country where rice is the main staple food. Therefore, WFP supports rice fortification as an effective approach to improve access to nutritious foods to 13 countries in the world. As more than 80 percent of the household in Timor-Leste consume rice as their staple food, the supplementation of a small number of micronutrients will bring benefits when the fortified rice becomes available through its social safety nets programmes including school feeding and/or through discussions to advocate for mandatory rice fortification in the commercial market. This is because rice is a good vehicle for fortification in schools to reduce malnutrition in Timor-Leste as it has proven in Bangladesh, India, and Cambodia. Therefore, the Government of Timor-Leste through the Ministry of Education requested an official letter to conduct the acceptability trials on fortified rice in 2018 but it has been deterred and completed in 2019.

Therefore, WFP is engaging with the Ministry of Education (MoE) to trial the acceptability of the fortified rice on testing and organoleptic (sensory) quality tests at two schools in the Metinaro administrative post in Dili. The Government of Timor-Leste has established the Technical Advisory Group (TAG) as a taskforce for rice fortification (RF) under the leadership of the Ministry of Agriculture and Fisheries (MAF) as a secretary of KONSSANTIL. This TAG group members decided to pilot the initiatives of rice fortification to be implemented in two schools in Dili municipality, an administrative post of Metinaro. These schools were EBC 03 Metinaro and EBF 1,2 Lebutun. The TAG group members consisted of technical staff from line Ministries under the umbrella of KONSSANTIL who supported the acceptability trials in these two schools. The pilot program will then be considered in 2020 in five schools in Dili Municipality if the acceptability trials of fortified rice are accepted in these two schools.

There were five schools such as EBC 03 Metinaro, EBF 1,2 Lebutun, EBC Farol, EBC 30 de Agosto - Comoro and EBC Esperanca da Patria-Becora defined by MoEYS to replace the 8 pre-selected schools in three different municipalities such as Baucau (**EBF 1,2 Quelicai Antigo, EBF 1,2 Eubere, EBC 3 Afaça /Quelicai, E B Catholica 1,2,3 de Afaça**) Bobonaro (**EBF 1 Daudo**) and Manufahi (**EBF 1,2 Boraulo, EBF 1,2 Daramata, EBF 1,2,3 Fahinehan**) by TAG-RF taskforce members under

KONSSANTIL. The reasons why these 8 schools were replaced by MoEYS is because the pilot program on fortified rice needs strenuous monitoring, supervision, and evaluation to understand the challenges and successes found during the period of the pilot program. Therefore, any challenges and the corrective measures could be documented and well addressed during the scale-up of the rice fortification program in 80 schools in three Municipalities (Baucau, Bobonaro, and Manufahi) in 2021 and beyond. These are the main purpose of having a pilot program for rice fortification because it is scaled up to 80 schools in 2021 and covering more schools beyond 2021.

OBJECTIVES

The objectives of the acceptability trial on rice fortification (RF) are to:

- obtain the acceptable organoleptic trial outcomes from school children during the trial of comparing conventional rice and fortified rice
- assess if fortification brings changes in the sensory qualities of rice through a combined sensory testing and consumption trial in school children

Sensory qualities affecting the acceptability of foods that will be measured in this trial are taste, smell, color, appearance and consistency or texture of rice. Besides, the consumption trial consists of measuring the leftover of rice after each meal has been eaten by each student during the entire duration of the trial. Rice leftover is averaged after each week in both schools and should be less than 25 grams leftover in the served plate where it considered to be finished.

STUDY PROTOCOLS WITH METHODOLOGY

Study designs and Settings

Qualitative research is adopted to obtain the student's perspective on fortified rice during the trial. The organoleptic test is used to obtain students' opinions on taste, smell, colour, appearance, consistency/texture of fortified rice compared with conventional rice during the trial. The single-blinded study was adopted to ensure no selected students who participated in the study noticed the fortified or non-fortified rice was served each period.

MATERIALS

The main materials utilised during the acceptability trials were scale precision 0.01gram, precision scale with capacity 5 Kg, basin, handschoen, bucket for mixing FRK with conventional rice, imported white rice, FRK, blacklight, labels, permanent markers, pen, pencil, battery (type AA and AAA) bowl 100 ml capacity, organoleptic quality test's questionnaires, consent forms, monitoring checklists.

METHODS

Questionnaires

The total of 68 out of 612 students selected students from both EBC 03 Metinaro and EBF 1,2 Lebutun schools. They were asked to notify parents so that their parents can complete the consent form prior to attend the trials of fortified rice. The selected students were also asked to complete

the organoleptic (sensory) quality tests ***on taste, smell, colour, appearance and texture*** after they have eaten the served rice from day one to day four each week for one month.

A total of 68 out of 612 students was selected from both EBC 03 Metinaro and EBF 1,2 Lebutun schools. They were asked to notify parents so that their parents can complete the consent form before attending the trials of fortified rice. The selected students were also asked to complete the organoleptic (sensory) quality tests ***on taste, smell, colour, appearance, and texture*** after they have eaten the served rice from day one to day four each week for one month.

A total of 1088 portions consisted of conventional and fortified rice was provided during four days of trials each week. The questionnaires adopted a “Likert scale” where the scaling from very bad to very good (1-5) on the mentioned organoleptic (sensory) tests. Each student has a personal code that has been written to each plate before the acceptability trials on rice fortification begin. After the completion of each test, every student was asked to complete the organoleptic (sensory) quality test with each unique code that has been assigned by the investigators.

The observation was also made each day throughout the acceptability trials on rice fortification. The observation was focused on the independence of students to complete the questionnaires each day after they complete the serves meal to avoid any biases for completion of the organoleptic testing on provided questionnaires. Besides, the assistance and the enumerators tasked were also to measure the leftover rice as part of observation if any from the assigned students' plates at both schools (EBC 03 Metinaro and EBF 1,2 Lebutun) as part of consumption trials based on protocols for this trial.

Participants

The eligible students from each school were assigned by the school after gaining approval from each individual and their parents. At EBC 03, a total of 40 students were selected from class 7 and class 8, which composed of 20 girls and 20 boys while from EBF 1,2 Lebutun, class 5 and class 6 were also selected with the total of 28 students where 7 girls and 7 boys from class 6 and 6 boys and 8 girls from class 5. A total of 68 students participated in the acceptability trials for rice fortification during 16 days of the schools' calendar. Each parent and or /caretaker was also asked to sign a consent form as a legal bonding to allow the selected student to participate in the acceptability trials.

Process of providing conventional rice and fortified rice to selected children during the trial

Based on the concepts of the methodology, week 1 and week 3 will only provide conventional rice while fortified rice, which the mixing of fortified rice kernel (FRK) with white rice was given during week 2 and week 4. The single-blinded test was adopted, therefore, all the selected students from both schools did not know about the process and when to serve the conventional and fortified rice. This was to ensure that the judgments that they made will not be based on which week they will be given fortified or conventional rice.

Organoleptic (sensory) quality test

Before the rollout of the acceptability trials on the rice fortification program in each selected school, the enumerators and the assistance investigators briefed the selected students on how the acceptability trials will be done including testing on organoleptic (sensory) quality test on taste, smell, colour, appearance, and texture. This is to ensure their participation in how to complete the provided questionnaires and to inform the process of the trials daily during the determined period for the acceptability trials of fortified rice.

After every student had finished the provided meal every day during 4 days in each week during the trial, the trained enumerators and assistance investigators observed directly to each plate to ensure if there was any leftover rice or not and for those students who had not finished their rice will be weighed and recorded to the provided consumption trial forms. This recorded form then tabulated to calculate the average of the leftover rice (conventional and fortified rice) each week. After that, each student received the organoleptic (sensory) quality test forms from the assistance enumerators or assistance investigators to complete it immediately after the meal each day. There was no student asked other fellow students to rate the scale of each sensorial test each day.

Quality Controls

The mixing of FRK with conventional rice during the second and fourth week of the acceptability trials begin one day before the day of providing the fortified rice at each selected school. This is to ensure the cook group opportunity to cook early the fortified rice that has been mixed one day earlier because school meal hours provided at 10:30-11:00 am every day and if the mixing is done on the same test day may not possible to meet the school meal hours.

The quality control is an important part of the acceptability trials to ensure the mixing of conventional rice with FRK. It is used to be using machinery called rice mixer at factory levels. However, it was only a maximum of 4 Kg of conventional rice to be mixed with 40 grams (ratio 99:1) at EBC 03 Metinaro and 3 Kg of conventional rice mixed with 30 grams of FRK at EBF 1,2 Lebutun in week 2 and week 4. Therefore, the acceptability trials' team members decided to use hand mixing in the provided basin. After mixed, the FRK and conventional rice that become fortified rice with an average of 10 samples with the total of already fortified rice of 100 grams in EBF 1,2 Lebutun and 20 samples with the sampling process at EBC 03 Metinaro. This mixing of FRK with conventional rice was measured the homogeneity of FRK with provided white rice. The FRK grains in each sample were collected of 100 grams of fortified rice the selected and counted to ensure the coefficient of variance (CV) of each sample later in the data analysis for homogeneity purposes. The minimum average of CV from each sample should be less than 15 % to ensure the homogeneity of the mixing of FRK with conventional rice was well mixed before cook.

Number of schools selected for acceptability trials of rice fortification in Municipality of Dili.

The two schools selected to be in the acceptability trial were decided by the members of the task-force of the technical advisory group (TAG) for rice fortification (RF) that was established under the umbrella of KONSSANTIL. The members of KONSSANTIL consisted of Ministry Agriculture and Fisheries (MAF), Ministry of Finance (MoF), National Directorate of Statistics, Ministry of Health (MoH), Ministry of Social Solidarity and Inclusions (MSSI), Ministry of Tourism, Commerce and Industry (MTCI) and Ministry of Education Youth and Sport (MoEYS). The members of the taskforce of TAG-RF consist of Director General, Head of Departments and senior staffs who have technically experienced programming and budgeting from each line Ministry.

The reason these schools were selected because it will be closed for TAG-RF taskforce members to involve daily supervision and monitoring during the acceptability trials. Higher technical levels such as the General Director level can also visit the targeted schools to observe the acceptability trial. Joint monitoring from TAG -RF members, which consisted of MoH, MoEYS, and MAP was done once due to their competing time with another program in their line departments in each Ministry.

Subjects

The students from 5th to 8th grade were selected for this trial. Between 10 to 20 students formed the panel in each grade. Two panels from each school were established in the trial, totaling several 68 participants. Two panels from EBF 1,2 Lebutun and another 2 panels from EBC 3 Metinaro in Dili Municipality. A total of 69 students were expected to be involved in the acceptability trials of

fortified rice. However, one student from EBF Lebutun grade 5th was not involved in the trial because this student has moved to another school when his parents moved away from the sub-village of Lebutun to Metinaro before the trial took place. Therefore, a total of only 68 students involved in the acceptability trials on fortified rice in both selected schools.

The trial imitated the real conditions of school feeding in the study; i.e. using the same quantity of rice, same preparations (dishes), and the same utensils that have been used in the same schools. However, in the second week, the investigator for acceptability trials found out that the school rice from National Logistic Centre (NLC) was a small, dark colour and had bad taste. Therefore, the WFP office decided to buy imported conventional rice (local brand: Folsom) and replace the available conventional rice and mixed with fortified rice kernel (FRK) that has been provided for acceptability trials. There was a recommendation to serve 100 grams of rice for each student by the designed methodology. This seems a small quantity, but it was kept for organoleptic (sensory) quality testing only and the selected students can have their normal rations after trial within each day if they would like to eat more each day after the trials.

Table 1. List of schools and number of students that was selected for the acceptability trials

School	Total current Students in each school	Class	Grade	Age range	M	%	F	%	Total
EBC Metinaro	543	Turma A, B & C	Grade 8	11 – 15 years	10	50	10	50	20
		Turma A,B, C	Grade 7	12 – 14 years	10	50	10	50	20
EBF Lebutun	69	Turma A	Grade 6	11 – 13 years	7	50	7	50	14
		Turma A	Grade 5	10- 12 years	6	43	8	57	14
2 - School		Total			33		35		68

Note: Details of sexes will be provided in the annex documents.

Principles of the acceptability trials

The trial was conducted in a cross-over way by giving conventional rice and fortified rice throughout the trial (4 weeks (16 days)). One week before the trial, parents and teachers were informed by school management team members to sign the consent form for their selected children to involve in the trials. Rice was cooked as a normal way and prepared with different ingredients based on a schedule for acceptability trial by using conventional rice in week 1 and week 3 and fortified rice in week 2 and week 4 (see table 2 below). The ration of the rice provided for each student was exactly 100 g per meal /day and the school meal will be served for 4 days each week for four weeks. The questions on organoleptic qualities (OLQ) was completed by the selected students for 4 days in two selected schools in each week under close monitoring of enumerators and investigators.

TIMELINES

Table 2 : Timeline for the acceptability trials at EBC 3 Metinaro and EBF 1,2 Lebutun

ACTIVITY	Week 0	Week 1	Week 2	Week 3	Week 4
Obtaining verbal consent forms from parents	29-31/07/2019				
Training of data Collectors	02/08/2019				
Serving NR/Organoleptic Questionnaire		19-22/8/2019			
Serving FR/Organoleptic Questionnaire			26-29 /8/2019		
Serving NR/Organoleptic Questionnaire				2-5/9/2019	
Serving FR/Organoleptic Questionnaire					9-12/9/2019

Table 3: OLQ testing everyday was conducted based on below categories

Organoleptic testing every day				
Very bad (1)	Bad (2)	Neutral (3)	Good (4)	Very good (5)

Scenario of Study

Before the start of the trial, the trial team will inform parents, teachers, and students about the objectives of the study and obtain verbal consent at least one week before the trial.

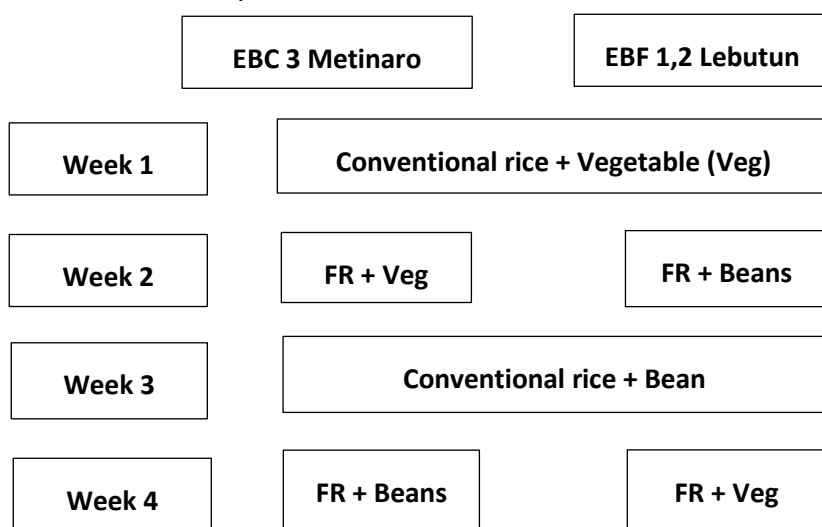


Figure 1. Trial design of the acceptability trial of fortified rice in 2 schools in Dili, Timor Leste

FR= Fortified rice; Normal rice used in school meals before fortification; Veg= Fortified rice with vegetable side dish; Beans= Fortified rice with side dish prepared with beans.

Rice preparation and serving during acceptability trials at two selected schools

Rice was cooked as usual ways by the cook members at the school kitchen and distributed to each class-room that has been defined for testing by each school. Each plate of rice was weighed exactly to the amount of rice approved for the study (**100 grams/person/day for 4 weeks (16 rations or portions)**). Only the acceptability trial investigator, assistance investigators, enumerators, and the cook team members know the served of fortified rice. Therefore, the single-blinded test on the acceptability of rice fortification was adopted. For both schools namely EBC 3 Metinaro and EBF 1,2

Lebutun one enumerator from Ministry of Education (MoE) and Department of Education from municipality of Dili was recruited, assigned and trained to oversees the selected students' attendance, meal distributions, actual consumptions and measurement of any leftover rice on the place that students may not finish every day. At the end of the meal session, the left-over in each plate was weighed and recorded on the provided special form if any, with the name of the student, the date and the student's code on the plate. This was done to know whether the selected students in each school accepted or not accepted the fortified rice based on designed methodology.

Table 4: The contents of fortified rice kernel (FRK) utilised during the trail

No	Vitamin & Mineral	Lot No.	EXP. Date
1	A	15000ugRE	16/09/2019
2	B1	35mg	
3	B6	50mg	
4	B12	100ug	
5	B9	13000ug	
6	B3	420mg	
7	Iron	200mg	
8	Zinc	300mg	

RESULTS

Table 5: Students attendance by gender each week during the trial at both schools

School	Week 1				Week 2				Week 3				Week 4			
	Male	%	Female	%	Male	%	Female	%	Male	%	Female	%	Male	%	Female	%
EBC 3 Metinaro	67	84	78	98	61	76	78	98	72	90	72	90	71	89	70	88
EBF 1,2 Lebutun	34	61	54	96	45	80	52	93	40	71	46	82	39	70	38	68
Total & Percentage (%)	101	74	132	97	106	78	130	96	112	82	118	87	110	81	108	79

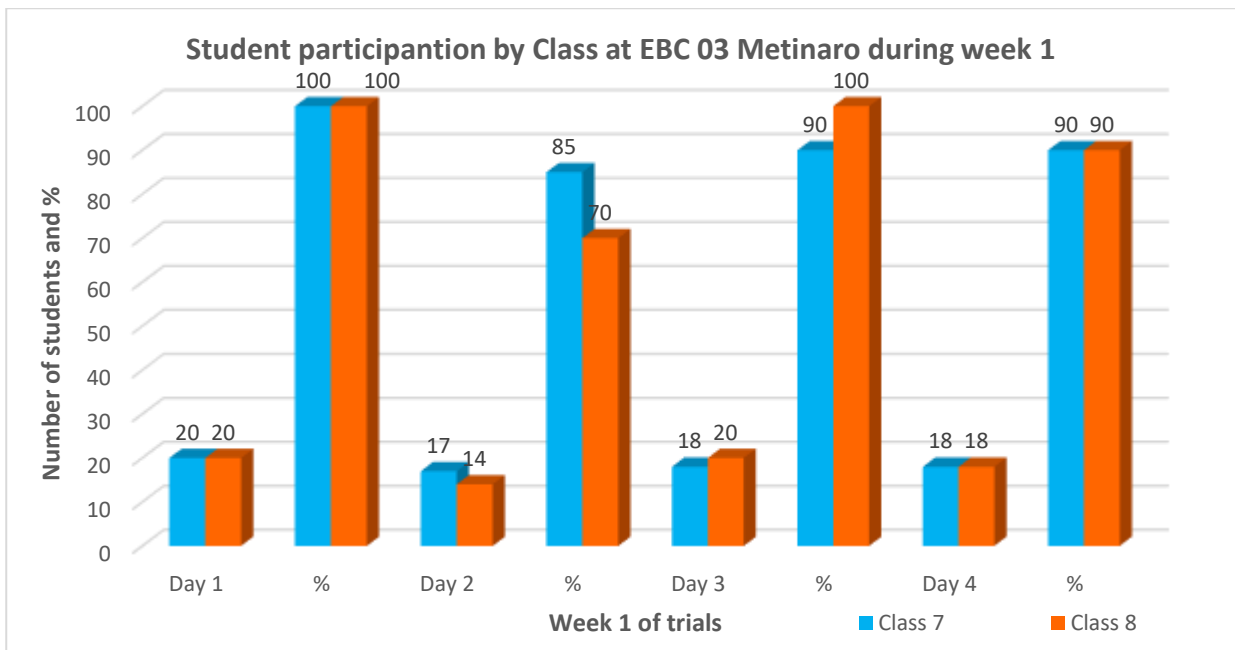


Figure 2: Week 1 attendance by Class wise at EBC 03 Metinaro

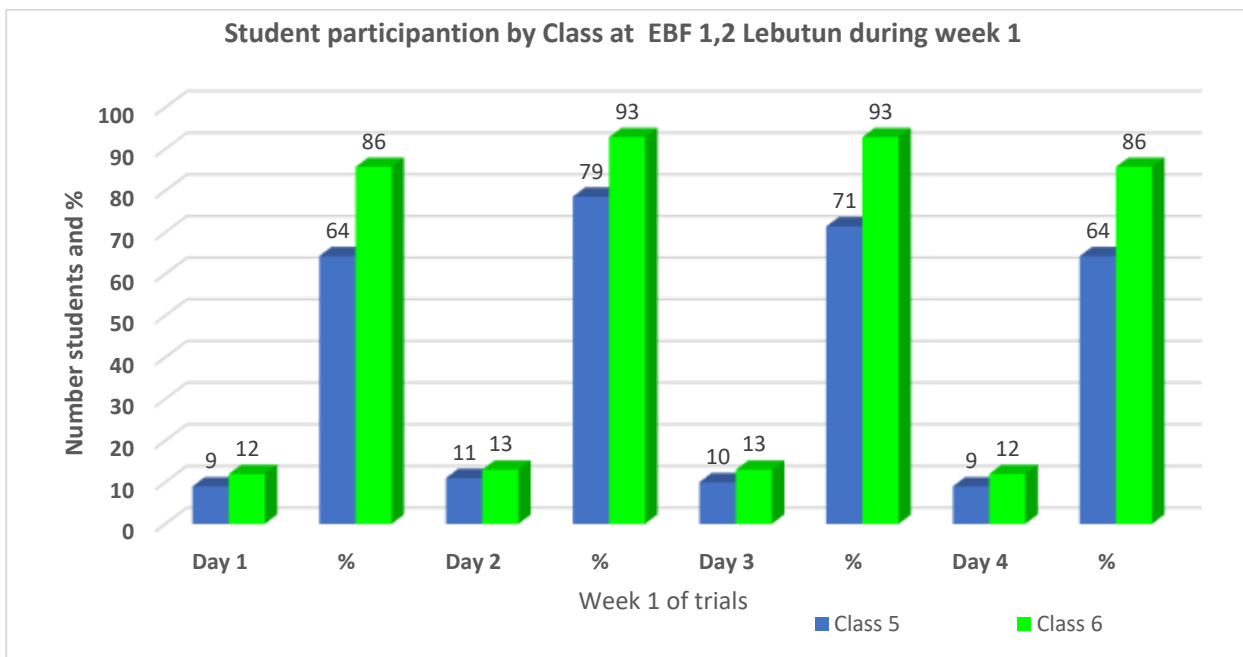


Figure 3: Week 1 attendance by Class wise at EBF 1,2 Lebutun

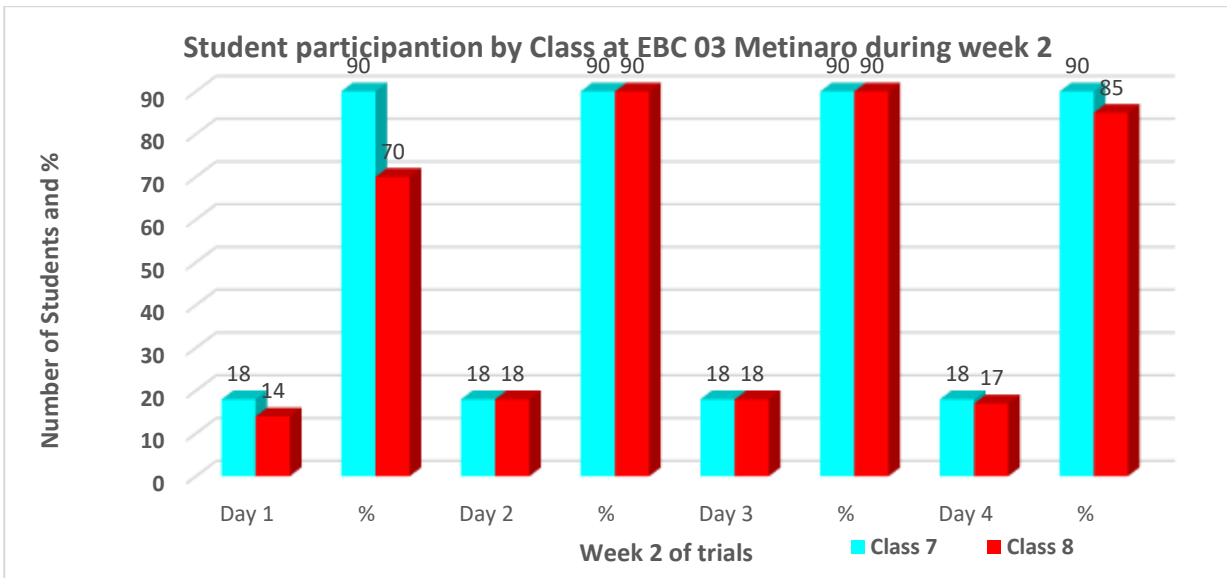


Figure 4: Week 2 attendance by Class wise at EBC 03 Metinaro

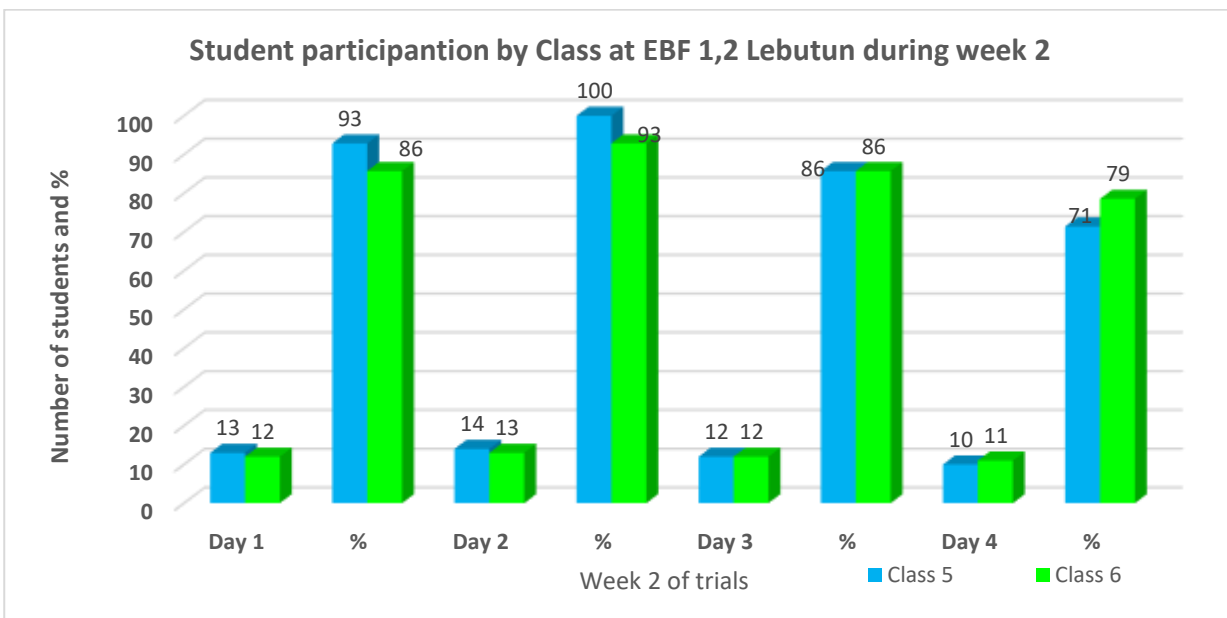


Figure 5: Week 2 attendance by Class wise at EBF 1,2 Lebutun

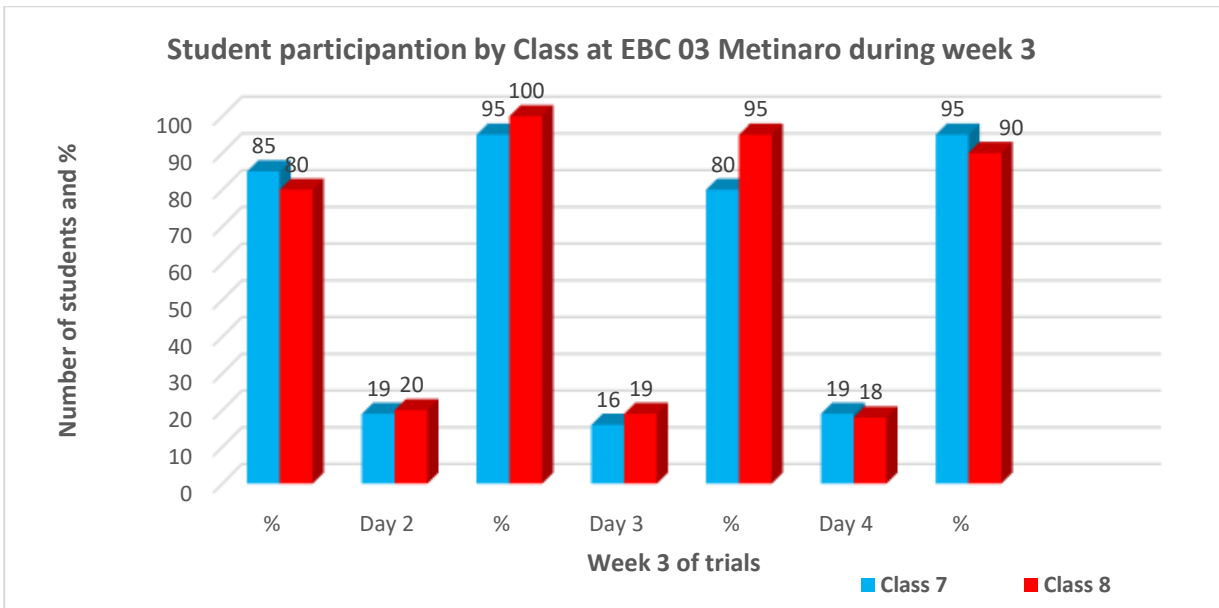


Figure 6: Week 3 attendance by Class wise at EBC 03 Metinaro

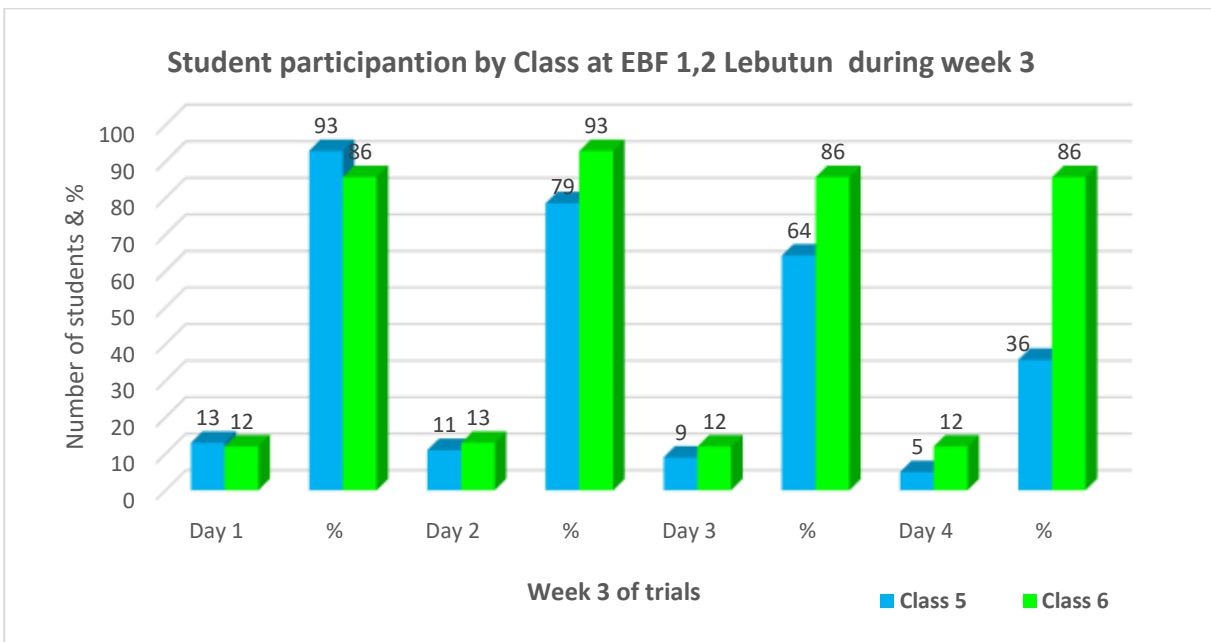


Figure 7: Week 3 attendance by Class wise at EBF 1,2 Lebutun

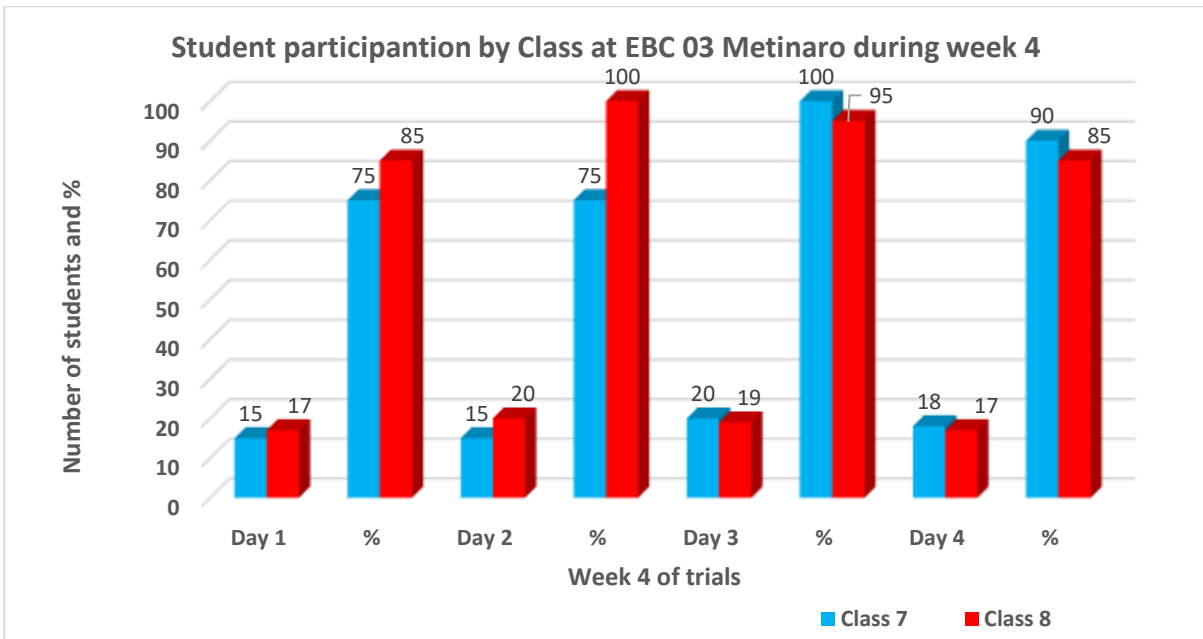


Figure 8: Week 4 attendance by Class wise at EBC 03 Metinaro

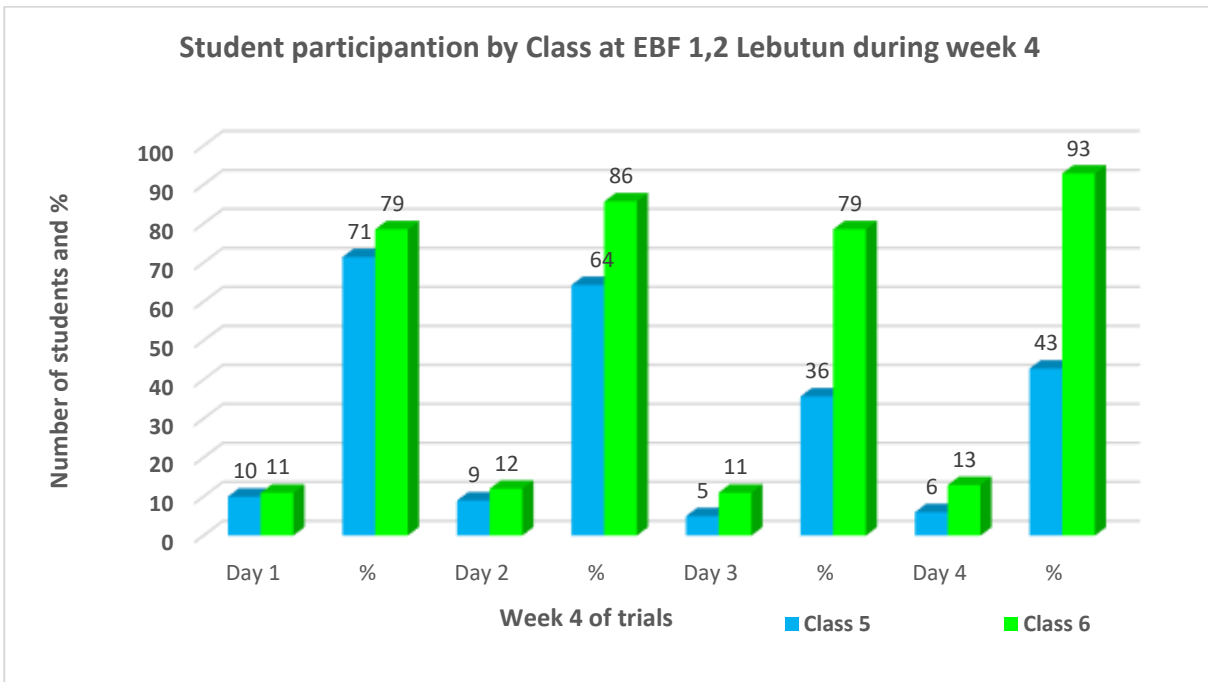


Figure 9: Week 4 attendance by Class wise at EBF 1,2 Lebutun

Response Rate of Students (attendance) at both schools over 4 weeks

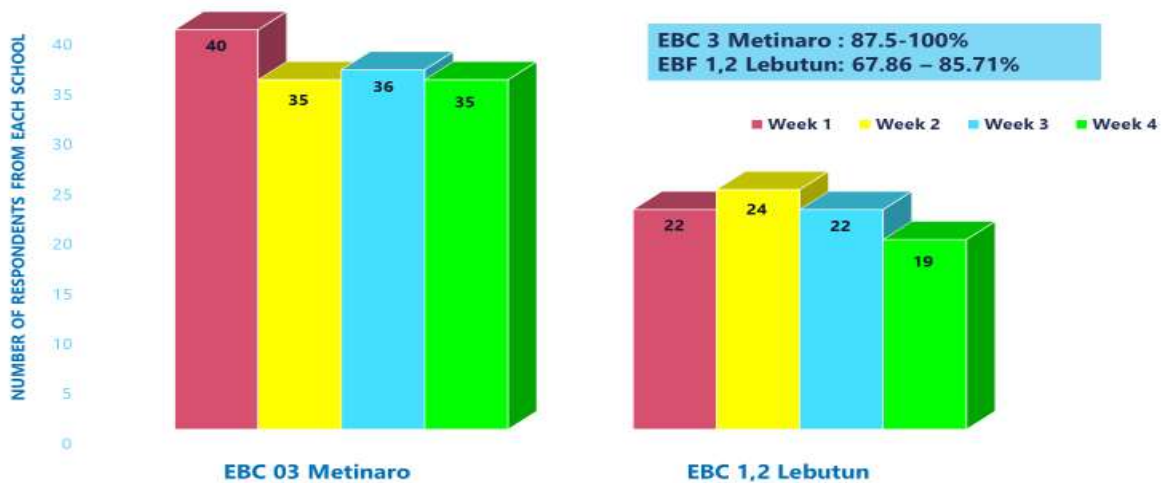


Figure 10: Response rate of students (attendance) at both schools over 4 weeks

The organoleptic (Sensory) quality testing of fortified rice.

The results of the four days a week of the questionnaires completed by each student participated throughout four weeks in EBC 3 Metinaro and EBF 1,2 Lebutun in 2019 as follows:

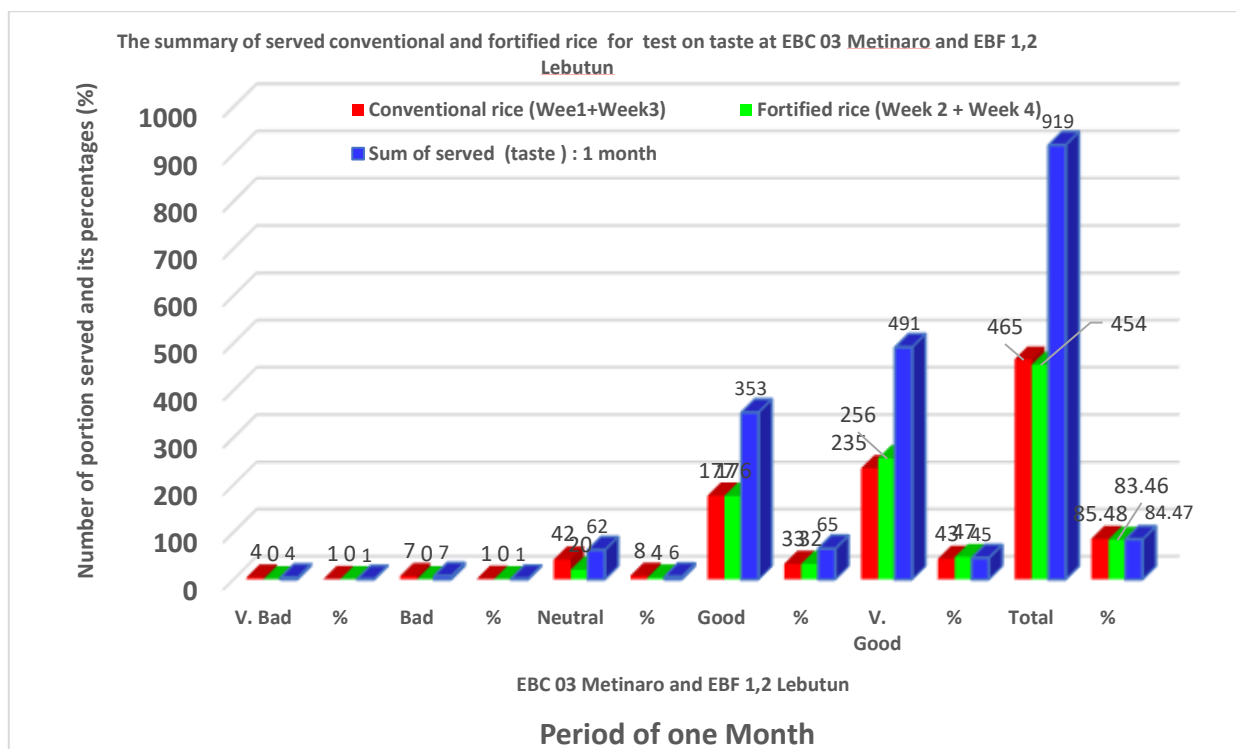


Figure 11: The cumulative organoleptic (sensory) quality test for taste on conventional (non- fortified rice) and fortified rice throughout four weeks at EBC 03 Metinaro and EBF 1,2 Lebutun

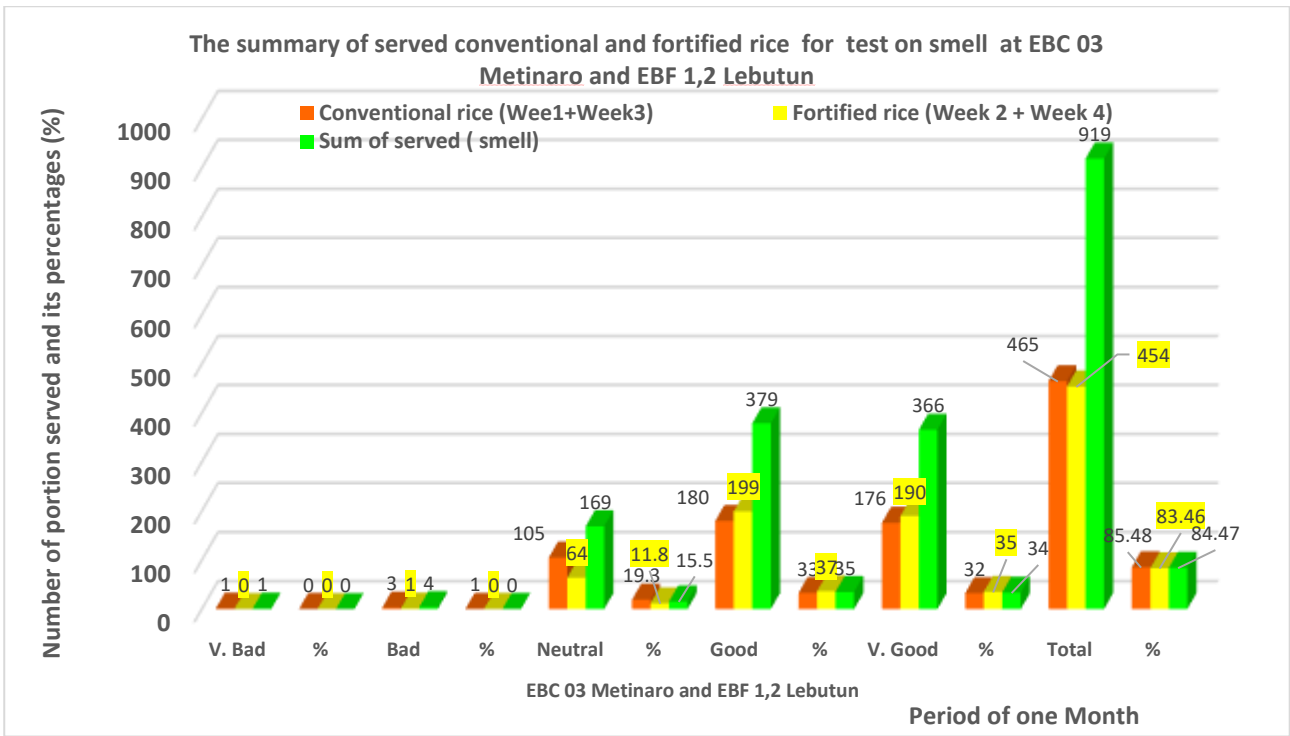


Figure 12: The cumulative organoleptic (sensory) quality test for smell on conventional and fortified rice throughout four weeks at EBC 03 Metinaro and EBF 1,2 Lebutun

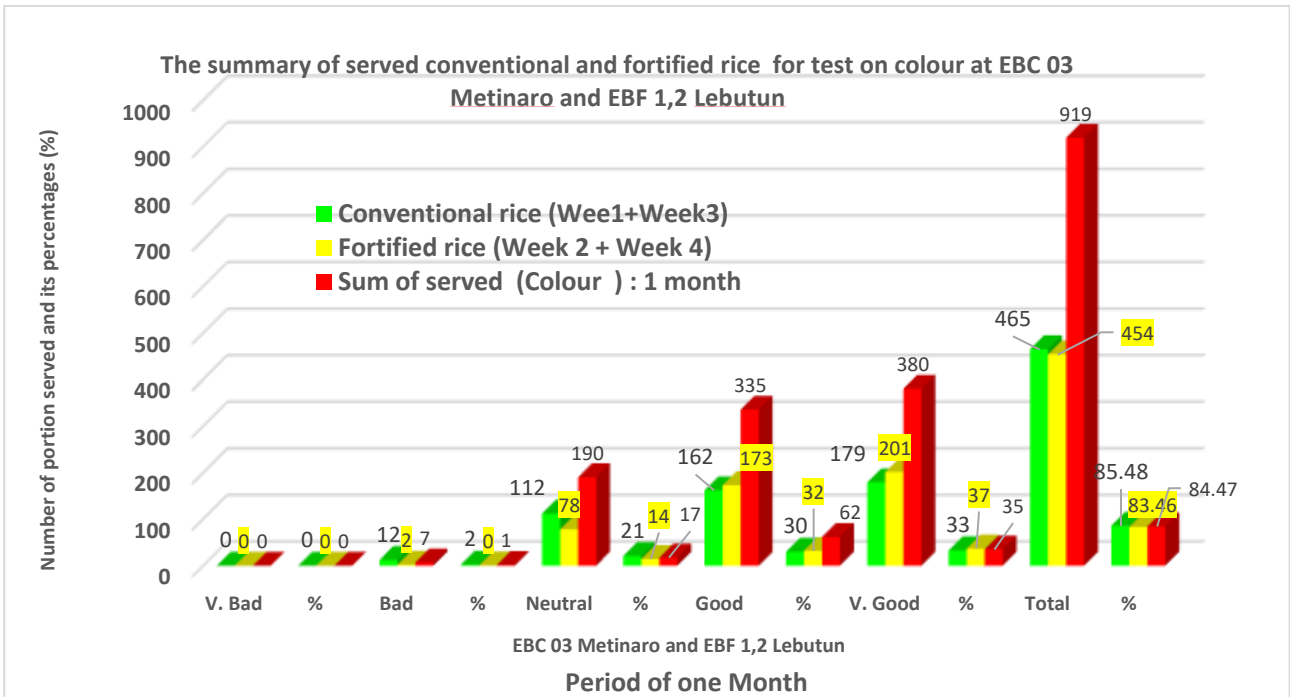


Figure 13: The cumulative organoleptic (sensory) quality test for colour on conventional (non- fortified rice) and fortified rice throughout four weeks at EBC 03 Metinaro and EBF 1,2 Lebutun

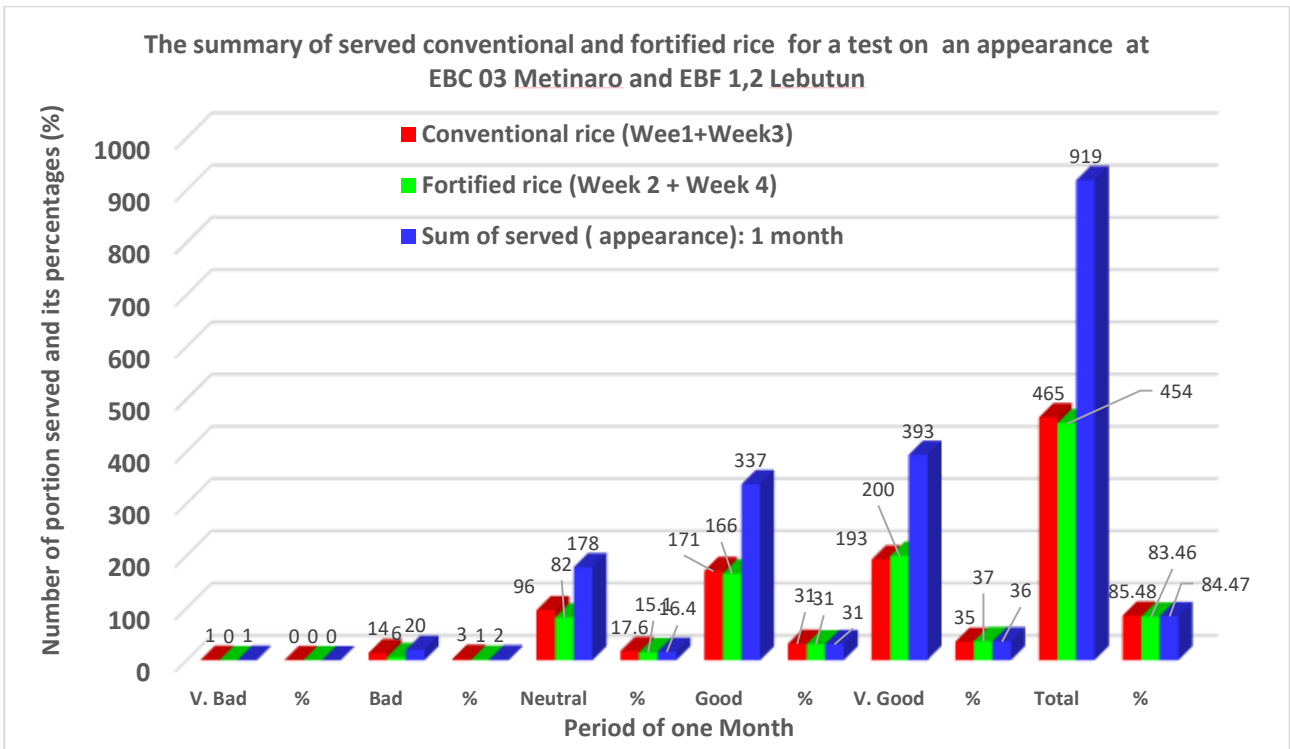


Figure 14: The cumulative organoleptic (sensory) quality test for an appearance on conventional and fortified rice throughout four weeks at EBC 03 Metinaro and EBF 1,2 Lebutun

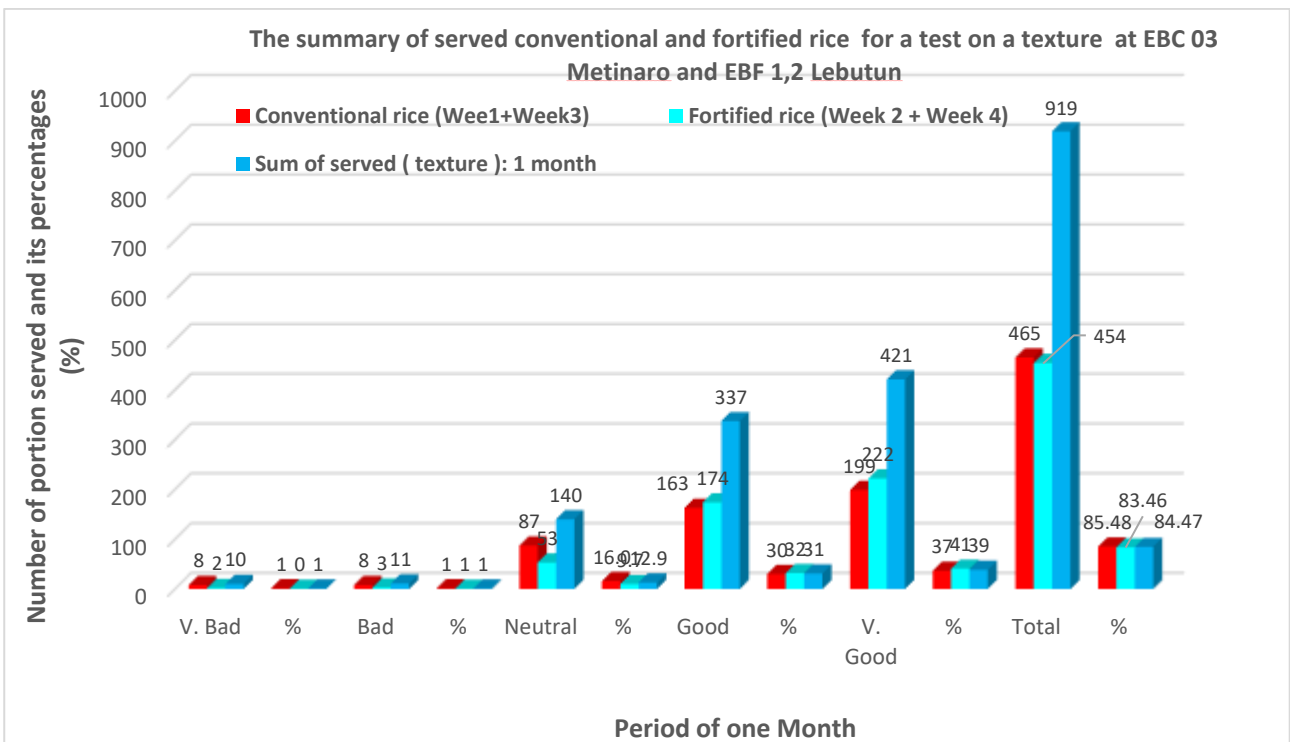


Figure 15: The cumulative organoleptic (sensory) quality test for texture on conventional and fortified rice throughout four weeks at EBC 03 Metinaro and EBF 1,2 Lebutun

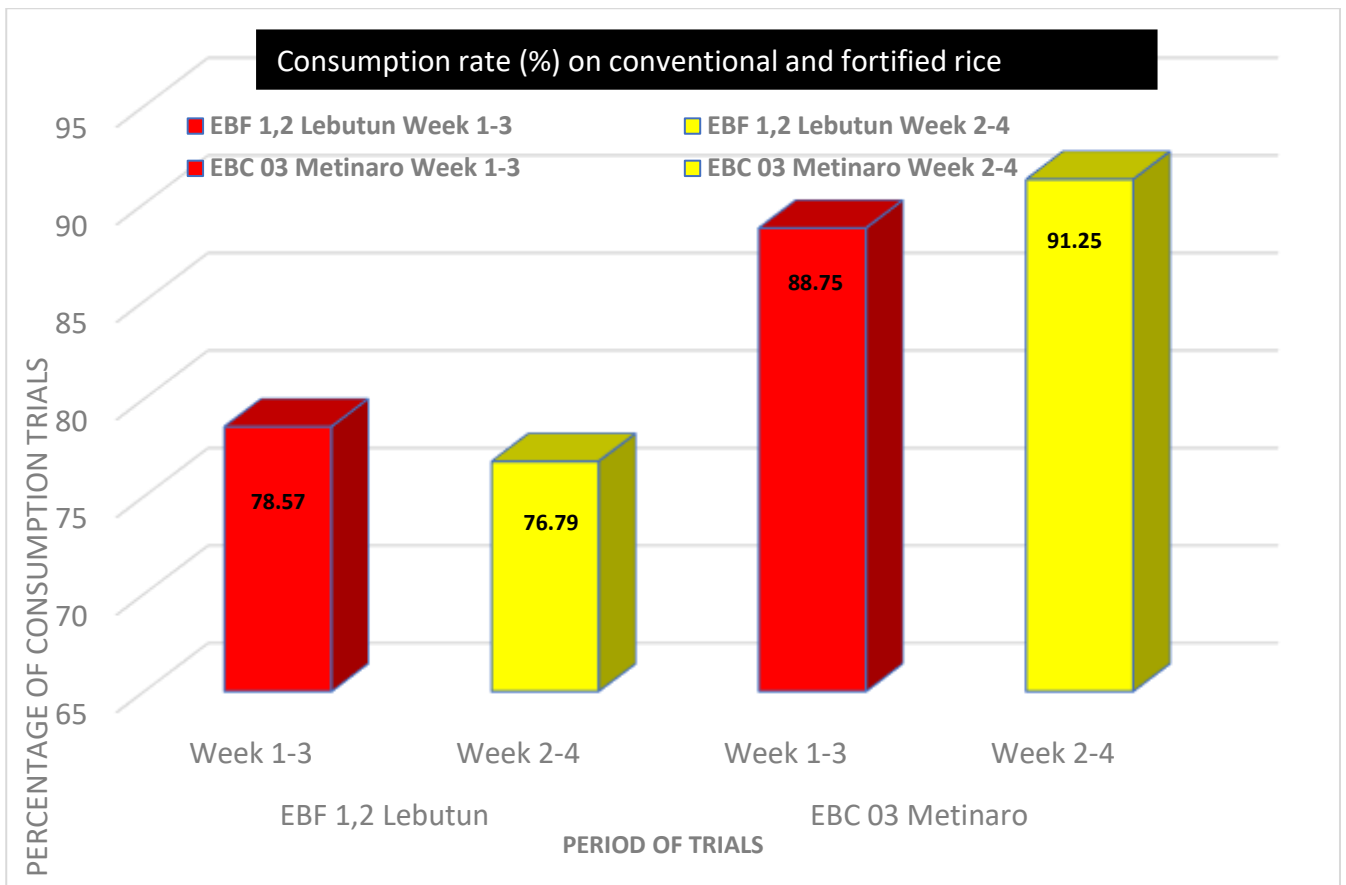


Figure 16: The consumption rate as per students turn-up to consume conventional and fortified rice

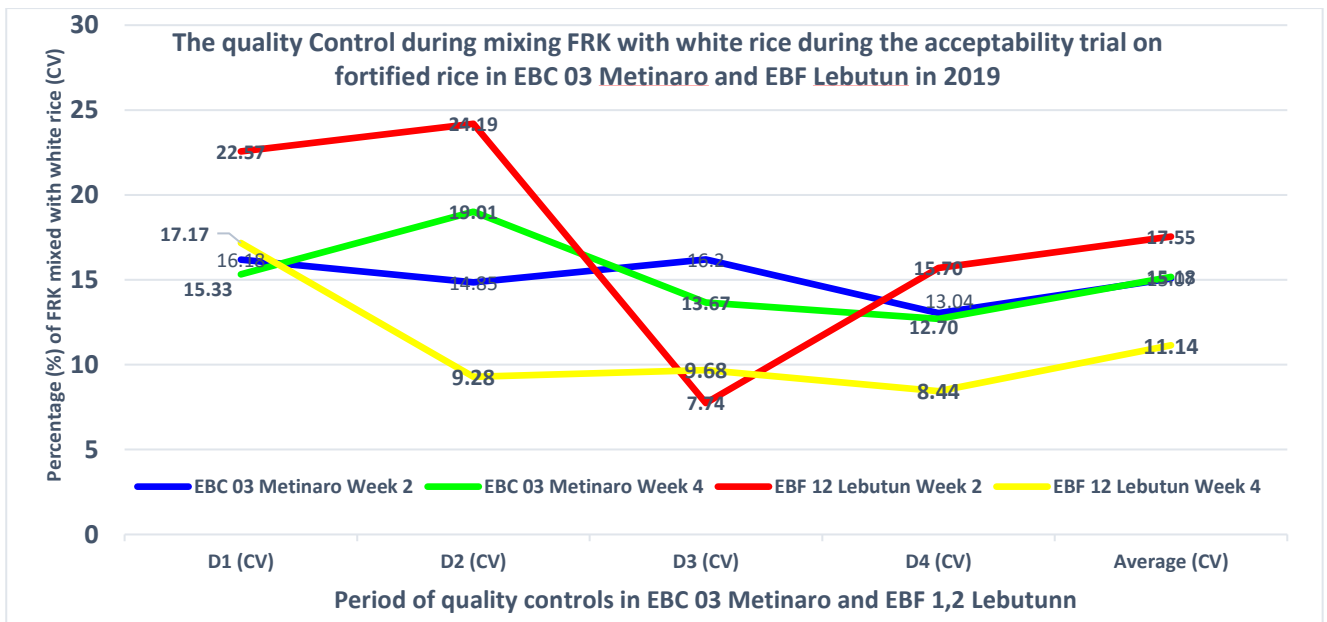


Figure 17: The quality control of mixing fortified rice kernel with conventional rice during the trial based on the values of coefficient variance (CV).

DISCUSSIONS

The variation of selected boys and girls who participated in the trial from both schools (EBC 03 Metinaro and EBF 1,2 Lebutun) was also different shown in table 5. At EBC 03 Metinaro, for instance, in week 1 a total of 67 (84%) boys out of 80 while in week 3 was 72 boys (90%) attended the trials. Furthermore, during week 2 at a total of 61 (76%) and in week 4 a total of 71 (89%) boys participated in the trial at the same schools. Meanwhile, for girl's participation in week 1 was 78 students (98%) out of 80 girls and in week 3 there was a total of 72 (90%) out of 80 girls who participated in the trials. In week 2, a total of 78 (90%) and in week 4 a total of 70 (88%) out of 80 girls involved in the trial, respectively. At EBC 03 Metinaro, there was a higher proportion of girls' involvement from 98% in week 1 and week 2 to a minimum of 90% to 88% in weeks 3 and 4. Nonetheless, the girl's participation slightly declined in week 3 and week 4. Boys participation, on the other hand, was 84% in week 1, 76% in week 2, 90% in week 3 and 89% in week 4. The participation of boys was a little bit declined in week 2 compared to girls while remaining weeks 3 and 4 both sexes participation was almost the same between 70 to 72%.

As shown in table 5, at EBF Lebutun, the participation of boys and girls during the acceptability trials on fortified rice was varied. During week 1 there was 61% (n= 34 boys), 45 boys (80%) in week 2, 71% (n=40 boys) and 39 boys (70%) only in week 4. Besides, the girls involvements is different compared to the boys were in week 1, there were 54 girls (96%) out of 56 participated in the trial, 52 girls (93%) in week 2, in week 3 there were 46 girls (82%) participated in the test and only 68% (n=38 girls) took part in the test in week 4. The boy's participation in the trial for 4 weeks was remained consistent while the girls' involvement in the trials was higher in week 1 to week 3 but then significantly fallen in week 4 (68%). This was due to several girls absent during the fourth week to support their parents to bring commercial products that their parents had prepared to be sold at Metinaro Market in this week alone.

Figure 2 shown high participation of class 7 and class 8 at EBC 03 Metinaro in week 1. There was 100% on day 1 and day 3 while day 2 was 70% and 90% for class 8 while class 7 begun with 100% on day 1, 85% in day 2 and 90% on day 3 and 4. Also, at EBF Lebutun, figure 3 explained fluctuated participations of class 5 with 64% in day 1, followed by 79% in day 2, 71% in day 3 and only 64% on day 4. The reason day 4 students participation declined at this school because on Thursday every week there was a market day in Metinaro administrative post where numbers of students were absent to support their parents to bring their commercial commodity from their gardens to be sold

at the market. The trend for high numbers of students absent at EBF 1,2 Lebutun was maintained across the weeks of trials as shown in figures 5, 7 and 9. The most class that affected by the market day on Thursday at the school of EBF 1,2 Lebutun was class 5's students. During week 1 the attendance of class 5 was 64%, 72% in week 2, 36% in week 3 and 43% in week 4. The most affected week was week 3 where the trend of attendance was declined from 93 % in day 1 to 36% for class 5. However, for class 6 the attendance rate was maintained high from 86% -93 % in the same week. The attendance rate for selected students from EBC 03 Metinaro was maintained 70-100% in week 1, 70-95% in week 2, 80-95 in week 3 and 75-100 in week 4 for both class 7 and class 8 as displayed in figure 2,4,6 and 8.

Figure 10 summarized the attendance rate from each school from week to week fluctuated due to student absences. In EBF 1,2 Lebutun, for instance, 24 out of selected 28 students attended the trial in week 2 and only 19 students participated in week 4, in EBC 03 Metinaro, (n=40 students) there was an average of 5 students absent in week 2 and 4. The average response rate at EBC 03 Metinaro was 88-100% and 68-86% at EBF 1,2 Lebutun during the implementation of four weeks of acceptability trials of fortified rice.

Organoleptic quality test

The acceptability trials on rice fortification was attended by 68 students. There were 919 (85%) out of 1088 of conventional and fortified rice that provided during the period of four weeks. During week 1 and week (figure11), a total of 465 cooked conventional rice was served to 68 students at both schools (EBC 03 Metinaro (n=68) and EBF Lebutun (n=28)) in four weeks periods. Furthermore, a total of 454 of fortified rice was also served in week 2 and week 4 at both mentioned schools (Figure 11) and targeted the same number of students. Nevertheless, as days gone, numbers of students did not participate in the trials during week two and four resulting less portions were served in week 1 and 3 (figure 1). This was due to students were sick, family reasons, without clear notifications and so on as reported by teachers. Therefore, a total of 919 (85%) of conventional and fortified rice out of 1088 of expected served during the acceptability trials at both selected schools throughout four weeks.

The organoleptic (sensory) testing on "taste" for conventional and fortified rice at both schools

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This was due to students who were sick, family reasons, without clear notifications and so on as reported by teachers. Therefore, a total of 919 (85%) of conventional and fortified rice out of 1088 of expected served during the acceptability trials at both selected schools throughout four weeks. There were five organoleptic (sensory) quality tests (Taste, Smell, Color, Appearance, and Texture (consistency) that each student completed for four days throughout each week after a meal has served. The scale of the “**Likert scale**” for the organoleptic (sensory) quality test was from 1 to 5 (**1. Very bad, 2.bad, 3. Neutral, 4. Good and 5. Very good**).

Taste

The analysis of taste for both conventional and fortified rice was also made to know whether there was an acceptance for fortified rice in contrast to conventional rice. A total of 465 (85.48%) portions out of expected 544 portions of conventional rice was served in both schools throughout week 1 and week 3.

During these two weeks, the students who participated selected 32% (n=176) the portions of the conventional rice with taste very good and another 33% (n= 180) chosen good taste and another 19%(n=105) was neutral in both weeks, while the remaining portion of 1 % (n=3) selected as a bad taste only. The figure 12 displayed that most selected students who participated in the acceptability trials on fortified rice had no problems with the organoleptic (sensory) quality test on taste of the served conventional rice in both mentioned weeks.

Also, the organoleptic (sensory) quality tests on taste for provided fortified rice at both schools, the data revealed in figure 5 that there were 454 (83%) portions of rice served out of expected 544 portions at both schools during week 2 and week 4. Out of this figure, 35% (n=190) portions of fortified rice as very good taste and 37% (n=199) with good taste and 12% (n=64) with neutral options while below 1% of the fortified rice portions selected as bad smell and none for very bad taste.

Smell

The organoleptic (sensory) testing on “smell” at both schools

The analysis of smell for both conventional and fortified rice was also made to know whether or not there was an acceptance for fortified rice in contrast to conventional rice. A total of 465 (85.48%) portions out of expected 544 portions of conventional rice was served in both schools throughout week 1 and week 3. During these two weeks, the students who participated selected 32% (n=176) the portions of the conventional rice with smell very good and another 33% (n= 180) chosen good smells and another 19%(n=105) was neutral in both weeks, while the remaining portion of 1 % (n=3) selected as a bad smell only. The figure 12 displayed that most selected students participated in the acceptability trials on fortified rice had no problems with the organoleptic (sensory) quality test on smells of the served conventional rice in both mentioned weeks.

In addition, the organoleptic (sensory) quality tests on smell for provided fortified rice at both schools, the data revealed at figure 5 that there was 454 (83%) portions of rice served out of expected 544 portions at both schools during week 2 and week 4. Out of this figure, 35% (n=190) portions of fortified rice as a very good smells and 37% (n=199) with good smells and 12% (n=64) with neutral options while below 1% of the fortified rice portions selected as bad smell and none for very bad smells.

color

The organoleptic (sensory) testing on “color” at both schools

Many people tend to concern about the color of foods they eat on their daily bases anywhere around the globe. Based on this concept, the organoleptic (sensory) quality tests on color were also included in the trial to know whether there is a curiosity of students on the color of fortified rice in contrast to the conventional one. During week 1 and week 3, the portions of conventional rice were served and asked students to judge the color of the provided conventional rice through provided questioners each day when they have finished. A total of 465 (85%) out of 544 expected 544 portions of conventional rice per fortnight were provided in these two weeks at EBC 03 Metino and EBF 1,2 Lebutun. There was 33 % (n=179) portions selected as a very good color by students at both schools, followed by 30% (n=162) for good color and 21% (n=112) selected neutral while remaining of 2% (n=12) chosen bad color and none for very bad color throughout week 2 and week 4.

To encounter the color of conventional rice provided in week 1 and week 3, all the students participated in the trials in week 2 and week 4 were also asked to make a judgment on the color of provided fortified rice in this fortnight by completing the organoleptic (sensory) quality test questionnaires. Figure 13 shown a total of 454 (83%) out of 544 portions of fortified rice that were provided in these two weeks at EBC 03 Metinaro and EBF 1,2 Lebutun. The participated students selected 37% (n=201) for very good color and 32% (n=173) for good color, follow by 14% (n=78) of students selected neutral and less than 1% for very bad and bad color. Most of the students based on figure 7 Shown they do not have any problems with the color of the portions of the served fortified rice in week 2 and week 4. Interestingly, no students selected very bad and bad color for fortified rice and only 2% for bad color for conventional rice in week 1 and week 3 at both selected schools.

The appearance

The organoleptic (sensory) testing on “appearance” at both schools

The appearance of provided conventional rice was also included as another organoleptic (sensory) quality test among other three sensorial tests discussed earlier. A total of 465 (85.48%) portions of conventional rice were prepared and served in week 1 and week 3. The numbers of students who participated in the trials at EBC 03 Metinaro and EBF 1,2 Lebutun completed the provided questionnaires to decide on organoleptic (sensory) quality test for the appearances of served rice. Most of the proportion from the respondents disperse within the options of neutral, good and very good appearances. In fact, out of 465 portions served in both schools in week 1 and week 3 (figure 14), follow by 35% (n=193) respondents selected very good appearance and 31% (n=171) indicated that the conventional rice was served in good appearance while the remaining portions were chosen 18 % (n=96) for neutral followed by another 3% (n=14) selected bad appearance of served conventional rice.

Following the testing on appearances for fortified rice in week 2 and week 4 was also done. As shown in figure 14, a total of 454 (83.46%) out of 544 portions of fortified rice were also provided in these two weeks based on the number of selected students who were present to participate in the trial during the period. Figure 14 displayed that the proportion of 37% (n=200) selected by students as a very good appearance and 31% (n=166) of portions selected by the respondents as a good appearance during the serving of fortified rice in week 2 and week 4. Meanwhile, 15% (n=82) portions rated as neutral while the remaining 1% (n=6) selected as bad appearance and none for very bad options. This means that most respondents had no problem with the appearance of both conventional and fortified rice at both schools during the trials.

The texture / consistency

The organoleptic (sensory) testing on “texture (consistency)” at both schools

The comparison of conventional and fortified rice on texture was also made in the acceptability trials on fortified rice as one of the last options among four other sensorial tests mentioned earlier. At the end of week 1 and week 3, the judgments on texture for the provided conventional rice was also done at EBC 03 Metinaro and EBF 1,2 Lebutun. As displayed in figure 15 that at the end of these two weeks, a total of 456 (85.48%) out of expected 544 portions of conventional rice were served. The respondents selected the percentage of 37% (n=199) portions of conventional rice selected as a very good texture, 30% (n=163) for good texture and 16% (n=87) neutral in both schools in two weeks period. The remaining 1% (n=8) selected very bad and bad texture of the served rice.

The continuation of testing on texture for fortified rice was also done in week 2 and week 4. This was to compare the judgments of the participated students on conventional rice in the previous fortnight with fortified rice to oversee their acceptance on the texture of served fortified rice in these 2 weeks. Figure 15 revealed that a total of 454 (83.56%) out of expected 544 portions were served at both EBC 03 Metinaro and EBF 1,2 Lebutun. Out of these portions, 41% (n=222) portions selected by the participated students as a very good texture, 32% (n=174) selected as good texture and 10% (n=53) with neutral options while the remaining less than 1% chosen bad and very bad textures within the period of tests for fortified rice. As the statement is shown in figure 15, most of the respondents could not differentiate the texture of conventional and fortified rice at the end of each week throughout acceptability trials on fortified rice.

[The consumption trials on provided conventional and fortified rice](#)

During week 1 and week 3 the percentage of average children who finished the normal rice in the plate was 78.57% at EBC Lebutun and 88.75% at EBC 03 Metinaro based on the number of present students out of selected number expected to attend the trial. In week 2 and week 4 the percentage of students who finished the fortified rice at EBF 1,3 Lebutun was 76.79%. This is because the number of students who participated in week four was declined and the number of absentees was increased out of the expected number of students (n=28) who supposed to participate in the trials. The reason the number of participated students was declined because the selected students were absent and not attended schools at this particular week and accompanied their parents to attend the market in Metinra since Lebutun is geographically remote and far from the administrative post of Metinaro. On the other hand, during week 2-4 at EBC 03 Metinaro the average proportion of children finished the fortified rice was 91.25% out of expected students (n=40). This means that the number of students was not completely participated in the trial during this fortnight. The student participated from both schools (EBC 03 Metinaro and EBF 1,2 Lebutun) have no problem with the organoleptic (sensory) quality tests on taste, smell, colour, appearance, and texture (consistency). The daily records on consumption trial have the highest percentage and none of the more left-over rice found in all the respondents' plates. respondent's decision was also shown in figure 17 in the trial results that the quality sensorial tests were accepted with the SD of 2.36 out of recommended SD 5.0 from the acceptability trials on the rice fortification manual.

CONCLUSIONS

The vast majority of the serving portions of conventional and fortified rice that served throughout the month of the trial at EBC 03 Metinaro and EBF 1,2 Lebutun could not be distinguished by all the students who participated in the acceptability trials.

In summary, the majority of the respondents involved in the acceptability trials on fortified rice judged that 919 portions of rice (conventional and fortified) out of expected 1088 portions during four weeks. It was shown that 33% (n=177) selected good taste followed by the very good taste of 43% (n=235) and the rest for neutral, bad and very bad in weeks 1 and 3 for conventional rice out of expected 544 portions. During weeks 2 and 4, there was 32 % (n=176) selected good taste and 47% (n=256) tasted very good for fortified rice in both schools out of 544 portions.

Another organoleptic (sensory) test tells us that 33% (n=180) students selected for good smell and 32% (n=176) for very good smell and the remaining 19% (n=105) for neutral in week 1 and 3 for normal rice. In addition, for fortified rice in week 2 and 4, there was 11.8% (n=64) for neutral, 37% (n=199) for good smell and 35% (n=190) selected very good smells. There was between 83.46 - 85.48% for both fortified and normal rice on testing the smells in two selected schools.

The color tests found that in weeks 1 and 3 the participants from the two schools selected given 21% (n=112) for neutral, 30% (n=162) selected good color and 33% (n=179) for very good color. Furthermore, the judgements given by the selected students from both school in week 2 and 4 on neutral was 14% (n =78), 32% (n=172) on good color and 37% (n=201). It shows students have no problem with the color of both normal and fortified rice out of 544 students.

The students from two selected schools were also provided their final thoughts on the appearance and texture of both normal and fortified rice provided in weeks 1, 2, 3 and 4, respectively. In weeks 1 and 3, almost 18% (n=96) though that they were neutral on the appearance of served rice followed by 31% (n=177) thought good appearance and 34% (n= 183) with very good appearance. Also, in weeks 2 and 4 where fortified rice was served, there was 15% (n=81) students thought neutral on the appearance of served rice followed by 30% (n=166) selected good appearance and 37% (n=200) for very good appearance.

The test on texture was also evaluated within four assigned weeks. In week 1 and 3 where normal rice was provided, almost 16 % (n=87) thought neutral on texture of both normal and fortified rice provided in week 1, 2, 3 and 4, respectively. In week 1 and 3, almost 18% (n=96) though that they were neutral on the appearance of served rice followed by 31% (n=177) thought good appearance

and 34% (n= 183) with very good appearance. In addition, in week 2 and 4 where fortified rice was served, there was 15% (n=81) students thought neutral on the appearance of served rice followed by 30% (n=166) selected good appearance and 37% (n=200) for very good appearance. The test on texture was also evaluated within four assigned weeks. In week 1 and 3 where normal rice was provided, almost 16 % (n=87) thought neutral on texture, 30% (n=163,) for good texture and 37% (199) judged very good texture to provided fortified rice during week 2 and 4 while very bad and bad were less than 1%, Neutral 10% (n= 53), good 32% (174) and Very good 41% (n=222).

This means that the participants could not be able to differentiate the taste, smell, color, appearance, and texture of conventional and fortified rice. Another determinant factors might be due to the provided imported rice was with very good quality (Local brand: FOLSOM) that most people liked it. Therefore, the respondents were unprecedentedly like the served rice in the trials in weeks 1 and 3 and weeks 2 and 4, respectively. This information needs to be shared with the Ministry of Education, Youth and Sport (MoEYS) as well as National Logistic Center (NLC) to provide good quality of rice. This was because the rice provided by NLC was very low quality, smelled and changing in color when the cook in the first week of the trial at both schools.

Finally, the overall of the tested organoleptic (sensory) quality tests on rice fortification during the trials found that most of the students could not differentiate the taste, smells, color, appearance, and texture of both conventional and fortified rice. Furthermore, the high percentage of consumptions trials with an average of above 75% for both conventional and fortified rice indicated that the participants in the trials accepted the trials of fortified rice. This was even further proved by the SD of the organoleptic (sensory) quality tests at both schools with the SD of 2.36 out of 5.0 that expected by the manual of the acceptability trials of fortified rice at EBC 03 Metinaro and EBF 1,2 Lebutun in Dili Municipality. The number of participants may be smaller though for the organoleptic sensory tests for fortified rice. However, it provided significant findings where the participants or students did not be able to tell the difference between fortified and conventional rice. By class-wise, the branches school namely EBF 1,2 Lebutun shown less participations of class 5 in week 3 and week 4 every last day of the test (Thursday) in a week due to their parents' commitments to take them to the weekly traditional markets in Metinaro administrative post without informing the school's teachers one day before market day or on the day of the market day. Therefore, most of the students in class 5 did not fully attend the trial. The remaining students from class 6 at the same school attended consistently throughout tests with 79-93% of attendance rate

as shown in figure 3. Also, during week 3 the participation of class 5 was 64% in day 3 and declined to only 36% in day 4 in the same week while in week 4 on day 3 for the same class 5 was 36% in day 3 and 46% in day 4. At the central schools (EBC 03 Metinaro), the majority of 20 students from each class (class 7 and 8) attended the trials with a significantly high rate of attendance. Throughout the four weeks periods, it was a minimum of 70% to 100 % of attendance for class 8 with a maximum of only 5 students absents in weeks 1,2 and 4 while for class 7 the attendance rate was between 85-100%.

The organoleptic (sensory) quality tests show that most of the students liked both conventional and fortified rice without telling the difference of taste, smell, color, appearance, and texture. The respondent's decision was also indicated that the quality sensorial tests were accepted with the SD of 2.36 out of expected SD 5.0. The proportion of the consumption trials was also above 75% at EBF Lebutun and 91% at EBC 03 Metinaro when the average leftover rice was a measure on a weekly bases. Less participation by class 5 at EBF lebutun in weeks 3 and 4 due to their family commitments to take them to the traditional weekly market that held every Thursday per week. Therefore, the attendance rate for this class was significantly declined compared to class 6 students' participation at the same schools.

RECOMMENDATIONS

Most of the students did not be able to differentiate between conventional and fortified rice. The SD of 2.36 values of consumption rate out of SD 5.0 tells that the students involved in the acceptability trials of rice fortification accepted the fortified rice to be included in their schools' meals based on the results of the organoleptic (sensory) quality tests. The proportion of the consumption trials was also above 75% at EBF Lebutun and 91% at EBC 03 Metinaro when the average leftover rice was a measure on a weekly base. Since the respondents could not differentiate the testing of the organoleptic (sensory) quality test on taste, smell, colour, appearance, and texture, therefore, the WFP country office of Dili would like to:

- Collaborate with KONSSANTIL and MoEYS to pilot program a rice fortification program through the school meal program at 8 selected schools that have been selected by KONSSANTIL to implement the rice fortification program.

- Collaborate with MoEYS, Ministry of State and Administration, NLC and Department of Education at Municipality of Dili to provide quality of rice that locally procured or even imported.

Finally, the pilot program in the five selected schools defined by Ministry of Education Youth and Sports (MoEYS) in Dili Municipality will be implemented in 2020 then the rice fortification program should scale up to reach 80 schools in 2021 and cover more schools beyond until reaching 400 schools to ensure the objective of the reduction of micronutrient deficiency, anemia and malnutrition on school aged-children in Timor Leste to be attained in three selected municipalities such as Baucau, Bobonaro and Manufahi. These five schools were selected to replace eight schools that were selected by TAG-RF taskforce members of KONSSANTIL because pilot program need a strenuous monitoring, supervision and evaluation and documentation challenges and successes and its corrective measures might be infeasible to do in the selected eight schools that spread out in the mentioned three different municipalities earlier and located in very remote areas. Therefore, regular and active monitoring, supervision and evaluation and documentation challenges and successes could not be properly done before scaling up to 80 schools in 2021.