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# Inadequacies in Good Manufacturing Practices and High Health Risks are Still Problems in Food Production in Public Preschools and Daycares in Rio Branco, Acre, Western Brazilian Amazonia

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### ABSTRACT

**Background/Objectives:** In Brazil, the National Program of School Feeding (PNAE), was created with the objective of meeting the nutritional needs of students, guaranteeing the adequate growth and development of children, and assuring quality sanitation of the food offered. With the intent to guarantee a high level of sanitation of the food offered in the educational field, Good Manufacturing Practices (GMPs) were also instituted. The objective of this study was to evaluate the GMPs employed to produce the food offered in the Rio Branco – AC school system's daycares and pre-schools.

**Methods:** The study was undertaken in 15 schools and 6 public daycares, corresponding with 50% of the total number of schools that admit preschoolers. A "List of Verification of Good Practices in School Feeding and Nutrition" was employed, and a final score was obtained for each school, through which the school was classified by the degree of health risk that it presented.

**Results:** In the 21 schools studied, inadequacies in all analyzed criteria were observed. When classified according to general health risks, 81% of the schools presented moderate health risks and 19% presented high health risks. The most scrutinized criteria were "Controlled Temperature Equipment," "Buildings and Installations," "Processes and Production," and "Sanitation of the Environment." The main problems detected were related to inadequate sanitation of the hands (90.48%) on the part of the food handlers; the absence of mandatory Good Practices and Standard Operational Procedures Manual (POP) (100%), and the absence of fans in the production area (95.24%).

**Conclusions:** The main problems identified in the evaluated school feeding production units were related to inadequate physical unit structures and the incorrect handling of the foods on the part of those involved in the production process. Therefore, the importance of continued training about Good Fabrication Practices (BPFs), the presence of nutritionists in sufficient numbers during the production process, and a restructuring of the physical space within the food production units need to be highlighted.

**KEYWORDS:** School feeding; Health risk; Food production; Good manufacturing practices.

**ABBREVIATIONS:** GMPs: Good Manufacturing Practices; BPFs: Good Fabrication Practices; PNAE: National Program of School Feeding; BPF: Good Fabrication Practices; UAN: Alimentation and Nutrition Units; DTA: Diseases Transmitted by Food; PNAE: National Program of School Feeding.

## INTRODUCTION

In Brazil, childhood education begins with daycare and preschool, covering children between the ages of 0 and 6 years of age. During this phase of life, the child is in the process of developing his or her motor and cognitive skills as well as forming proper feeding habits that will likely persist into adulthood.<sup>1</sup>

In Brazil, the National Program of School Feeding (PNAE) was created in the 1950's,<sup>2</sup> and it is one of the oldest public policies in the country. Besides this, it is one of the largest school feeding programs in the world, both in number of students attending and in allocated resources.<sup>3</sup>

The program aims to meet the nutritional needs of students during their stay in the classroom, and to contribute to the growth, development and knowledge of the students, including the formation of good eating habits. City and state administrators at PNAE are responsible for assuring the correct acquisition, transport, and storage of raw materials, as well as the sanitary preparation of the meals.<sup>4</sup>

Good Fabrication Practices (BPF) were adopted to guarantee the quality and sanitation of the meals offered within the school environment. They relate to the products, processes, services and buildings involved in the production of food. The legislation concerning BPFs can be found in Ordinance SVS/MS #326, which food service organizations need to follow to be in compliance with the law.<sup>5</sup>

Kitchens designated for school food preparation, including distribution locations, should be structured and planned in accordance with BPF guidelines, with the goal being to guarantee sanitary conditions. The majority of kitchens in Brazilian public schools do not possess adequate facilities to handle food hygienically, from raw material reception to distribution, with cross contamination being a distinct possibility.<sup>6</sup>

The food produced in the school Alimentation and Nutrition Units (UAN) should have adequate nutritional value, meeting the nutritional needs of the appropriate age group, and they should have organoleptic appeal and be sanitary. Sanitation quality is an indispensable factor in the handling of food, because it is related to the promotion and maintenance of the student's health.<sup>7</sup>

Insufficient sanitation control is a determining factor in the appearance of Diseases Transmitted by Food (DTA), caused mainly by contamination and bacterial growth in food. The age group of students that attends daycare and preschool needs greater attention in relation to sanitation control, since this group of individuals is more vulnerable to the development of DTAs.<sup>1,8-10</sup>

Knowing the extreme importance of verifying the preparatory conditions for school meals so that strategies can be created to guarantee a high level of sanitation, the objective of

this study was to evaluate the GMPs of the school feeding programs offered in the city daycare and pre-school system of Rio Branco – Acre.

## MATERIALS AND METHODS

This study was conducted in the children's county school system of Rio Branco, capital of the state of Acre. The city is situated in the north of Brazil (latitude: 9 58'29"; longitude: 69 48'36"; altitude: 153 meters), in the administrative region of Lower Acre, and its population is approximately 364 thousand (Figure 1).

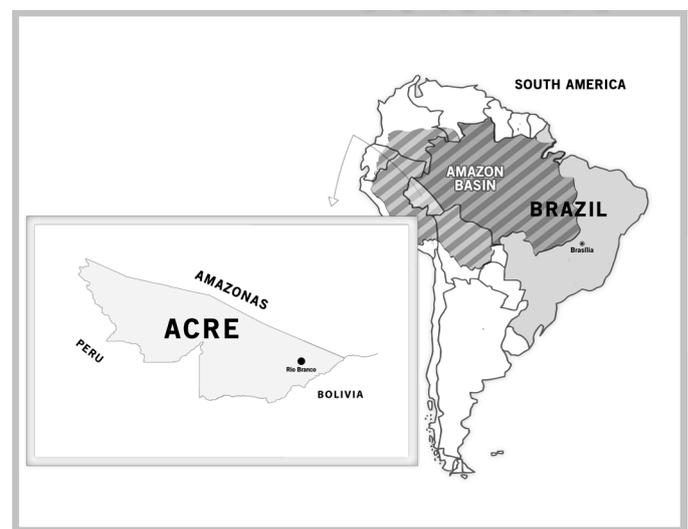


Figure 1: Map showing the location of Rio Branco, capital of the state of Acre, in Western Brazilian Amazonia.

In the county, the National Program of School Feeding (PNAE) was instituted since its emergence on the national scale. County school feeding is responsible for 42 public schools of children's education, attending to approximately 9,300 children. The present observational, descriptive, and cross temporal study investigated 21 schools (15 pre-schools and 6 daycares) that represent 50% of the total public schools that admit preschool age children from the county. The selection of the schools was determined by a simple random drawing.

The data were collected from the first semester of the year 2015. Adherence to good manufacturing practices was rendered through a "List of Verification of Good Practices in School Feeding and Nutrition," with a basis on Brazilian legislations RDC 216/2004,<sup>11</sup> Resolution SS-196/1998 (SÃO PAULO, Brazil, 1998), Ordinance CVS 06/1999 (SÃO PAULO, Brazil, 1999), Ordinance 542/2006 (RIO GRANDE DO SUL, Brazil, 2006). This list contains basic aspects of production activities and their installations: storage, physical area of the kitchen and cafeteria, utensils, water supply, integrated control of vectors and urban pests, garbage, handlers, snack ingredients, production flow, handling and contamination.

The School Inspection Guide was applied to six cri-

teria: buildings and installations of the food preparation areas, temperature control equipment, handlers, reception, processes and productions, and environmental sanitation, and it was composed of 113 items with response options YES, NO, and NOT APPLICABLE. Each item on the verification list was attributed grades that varied from zero to eight, according to the degree of risk and importance to the security of the food (08 – for conditions/situations that permit the multiplication of microorganisms; 04 – for conditions/situations that permit the survival of microorganism; 02 – for conditions/situations of cross contamination with direct contact with the food; 01 – for conditions/situations of cross contamination without direct contact with the food; 0 – for conditions/situations of no-compliance; NA – for conditions/situations that don't apply to the observation).

Besides this, a weight (k, equal to 10, 15, 25, or 30) was assigned to each criterion according to the degree of risk and importance to the security of the food. For the calculation of each point obtained for the criterion on the verification list, the formula  $PB_x = (\sum X / P_x - \sum NA_x) k_x$ , where:  $PB_x$ : score reached for the criterion X (1 to 6);  $\sum X$ : Sum of the grades obtained in the items of the criterion X;  $P_x$ : Maximum score possible for the criterion X;  $\sum NA_x$ : Sum of the grades of the non-applicable questions for the criterion;  $k_x$ : Weight attributed to criterion X, was applied. After the calculation of the obtained score for each criterion (PB), the results were added together. A final score was obtained for each school (presented as %), and with this score as a base, the school was classified by criteria and by total score according to health risk: 0 to 25 - very high health risk; 26 to 50 - high health risk; 51 to 75 moderate health risk; 76 to 90 – low health risk; 91 to 100 very low health risk.

**RESULTS**

In the 21 schools studied, inadequacies were observed for criteria all analyzed. When classified according to general health risks, 81% of the schools presented a “moderate” health risk and 19% a “high” health risk. In stratifying the health risk by observation criteria, the schools remained in the “moderate” to “high risk” category, except under the “Reception” criterion (Table 1).

Criteria	Risk(%)	Classification of Risk
Buildings and Installations	49.99	High
Temperature Control Equipment	35.89	High
Handlers	67.63	Moderate
Reception	92.38	Very Low
Processes and Production	46.94	High
Environmental Sanitation	47.79	High

Table 1: Distribution of risk classifications by criteria. Rio Branco – Acre, 2015.

Among the criteria evaluated under “Buildings and Installations of the Area of Food Preparation” (Table 2), only the constitution and state of conservation of the walls of the production area showed adequacy of more than 50%. In relation to

the “Area of Storage in Ambient and Controlled Temperature,” the main items that did not conform were the protection of the inferior opening of the doors and windows and the temperature control of the equipment (Table 2).

In relation to the handlers, in 76.19% of the schools these handlers were not “Correctly uniformed”, 52.38% used adornments (“Absence of Accessories/Adornments”), and in all of the schools, collaborators who had not received food and nutritional safety training were present (All that participated in training involving Food Safety) (Table 2).

The criterion “Reception” was the one in which the schools were most in accordance to the legislation. In more than 90% of the establishments, the characteristics of “Integrity of packaging is verified ” and “Expiration date is verified” were observed. (Table 3).

The criteria referring to “Processes and Productions” presented high non-adherence to the legislation. In 90.48% of the schools, the handlers sanitized their hands in an inadequate fashion (“Collaborators sanitise their hands appropriately”) and in 61.90% the same handlers disinfected vegetables and fruits in an incorrect way (“Legumes and vegetables are disinfected in an appropriate way”). None of the schools possessed the mandatory Good Practices and Standard Operations Manual (POP) (“Existence of Good Practices Manual accessible to the handlers”) (Table 3).

In relation to “Environmental Sanitation”, 66.67% of the schools disposed of waste in an inadequate way (“Waste disposed by correct methods and in adequate recipients”) and held the practice of sweeping a dry floor (“Existence of the practice of sweeping a dry floor in the production area”). All of the schools used sponges made from abrasive material that were not boiled daily (“Brushes and sponges are not made of abrasive materials”; “Dish sponges are boiled every day”). In 85.72% of the schools, the disinfection and drying of the utensils were done the wrong way (“Chemical disinfection of utensils and equipments done the correct way”; “Utensils and equipments are dried without the use of towels”). The existence of pests was evident in 76.19% of the pest and urban vectors (“Non-existence of evidences of rodents, cockroaches and insects”; Existence of documents that prove the integrated control of vectors and pests”) (Table 3).

**DISCUSSION**

Among the activities developed by the managers of the public school feeding program in Rio Branco are the elaboration and execution of menus, the development of policies of alimentation and nutrition in the school environment, the nutritional evaluation of students, and training in food safety of the collaborators involved in the process of school feeding.

The program in the county relies on the presence of

Item Evaluated	Yes		No		NA	
	N	%	N	%	N	%
<b>“Buildings and installations of the food preparation area”</b>						
<i>Satisfactory hygienic conditions in the surroundings</i>	6	28.57	15	71.43	-	-
<i>Hygiene and conservation of the floors and production areas</i>	9	42.86	12	57.14	-	-
<i>Adequacy of the constitution and the state of conservation of the walls</i>	11	52.38	10	47.62	-	-
<i>Doors of the productions areas possess automatic closing and protection of the inferior openings</i>	-	-	21	100	-	-
<i>Windows of the production area covered with screens</i>	-	-	18	85.71	3	14.29
<i>Lamps in the production area with security against accidental falls</i>	-	-	21	100	-	-
<i>Nonexistence of fans in the production area</i>	1	4.76	20	95.24	-	-
<i>Sink exclusive for the sanitation of hands</i>	-	-	21	100	-	-
<b>“Storage Area in ambient and controlled temperatures”</b>						
<i>Door with automatic closing action and protection over the inferior openings</i>	-	-	21	100	-	-
<i>Windows/openings covered with millimetre screens</i>	3	14.29	18	85.71	-	-
<i>Shelves are washable and impermeable</i>	6	28.57	15	71.43	-	-
<i>Storage of the cleaning material in exclusive area</i>	10	47.67	11	52.38	-	-
<i>Sufficient refrigerator and freezers</i>	19	90.48	2	9.52	-	-
<i>Chambers/refrigerators are regulated in a way to keep food at the correct temperature</i>	-	-	21	100	-	-
<i>Accumulation of ice and obstruction of air diffusers in the refrigeration and freezing equipment</i>	15	71.43	6	28.57	-	-
<b>“Handlers”</b>						
<i>Correctly uniformed</i>	5	23.81	16	76.19	-	-
<i>Periodically renewed medical exams</i>	11	52.38	3	14.28	7	33.34
<i>Absence of Accessories/Adornments</i>	10	47.62	11	52.38	-	-
<i>All that participated in training involving Food Safety</i>	-	-	21	100	-	-

**Table 2:** Distribution of the items evaluated by the criteria of “buildings and installation in the area of the preparation of food”; “storage areas in ambient and controlled temperatures” and “handlers”. Rio Branco – Acre, 2015.

Items Evaluated	Yes		No		NA	
	N	%	N	%	N	%
<b>“Reception”</b>						
<i>Characteristics of the food are verified</i>	19	90.48	2	9.52	-	-
<i>Integrity of packaging is verified</i>	19	90.48	2	9.52	-	-
<i>Expiration date is verified</i>	20	95.24	1	4.76	-	-
<b>“Processes and Productions”</b>						
<i>Collaborators sanitise their hands appropriately</i>	2	9.52	19	90.48	-	-
<i>Foods are taken from their boxes and are received at the time of storage</i>	11	52.38	10	47.62	-	-
<i>Existence of products with expired dates in the storage area</i>	3	14.29	18	85.71	-	-
<i>Existence of cardboard boxes in storage area under cold air</i>	7	33.33	14	66.67	-	-
<i>Food genres are available in an appropriate form in the refrigeration</i>	14	66.67	6	28.87	1	4.73
<i>Legumes and vegetables are disinfected in an appropriate way</i>	7	33.33	13	61.9	1	4.77
<i>Defrosting done the appropriate way</i>	15	71.43	6	28.57	-	-
<i>Existence of Good Practices Manual accessible to the handlers</i>	-	-	21	100	-	-
<i>Existence of the mandatory 04 POPs accessible to the handlers</i>	-	-	21	100	-	-
<i>Foods in distribution do not go more than 2 hours from the end of preparation until distribution</i>	15	71.43	6	28.57	-	-
<b>“Environmental Sanitation”</b>						
<i>Waste disposed by correct methods and in adequate recipients</i>	7	33.33	14	66.67	-	-
<i>Area of waste external, isolated or treated to avoid contamination</i>	17	80.95	4	19.05	-	-
<i>Garbage removed daily or always when necessary</i>	21	100	-	-	-	-
<i>Environmental sanitation done in an appropriate way</i>	16	76.19	5	23.81	-	-
<i>Brushes and sponges are not made of abrasive materials</i>	-	-	21	100	-	-
<i>Cleaning utensils of the handling area are different than the cleaning utensils used for bathroom sanitation</i>	20	95.24	1	4.76	-	-
<i>Existence of the practice of sweeping a dry floor in the production area</i>	14	66.67	7	33.33	-	-
<i>Chemical disinfection of utensils and equipments done the correct way</i>	3	14.28	18	85.72	-	-
<i>Utensils are kept under protection</i>	8	38.1	13	61.9	-	-
<i>Utensils and equipments are dried without the use of towels</i>	3	14.28	18	85.72	-	-
<i>Non-disposable cleaning cloths are changed every 2 hours and sanitised the correct way</i>	2	9.52	19	90.48	-	-
<i>Dish sponges are boiled every day</i>	-	-	21	100	-	-
<i>Pest control is done by a third party company</i>	20	95.24	1	4.76	-	-
<i>Nonexistence of evidences of rodents, cockroaches and insects</i>	5	23.81	16	76.19	-	-
<i>Existence of documents that prove the integrated control of vectors and pests</i>	3	14.29	18	85.71	-	-

**Table 3:** Distribution of the items evaluated by the criteria of “reception”; “processes and production” and “environmental sanitation”. Rio Branco – Acre, 2015.

just two responsible nutritional technicians, charged with the execution of the same. According to Resolution CFN #465/2010, this number of professionals is insufficient for the development of the activities of the program, because the same legislation specifies that the modality of children's education (daycare and pre-school) should have one nutritionist for every 500 students or fraction therefore.<sup>12</sup> In this way, the county should rely on approximately eighteen nutritionists to properly execute the PNAE.

Sidaner, Balaban and Burlandy<sup>13</sup> affirmed in their study that, in 2010, 15% of Brazilian counties do not possess a nutritionist of professional stature due to a lack of resources and of professionals in the region.

In all alimentation and nutritional units (UAN) in the schools visited, nonconformities in all of the analyzed criteria were observed, indicative of potential contamination risks in the foods produced in those schools.

As to the building conditions, various non-conformities were observed, such as waste, objects in disuse, animals or insects and rodents in the surroundings of the UANs, and an absence of protection in the inferior openings and in screens in the windows and production areas. Similar results were observed by Oliveira, Brazil and Taddei, who sited greater inadequacies in terms of physical structures of the schools studied, including doors without baseboard protection and, additionally, windows without screens.<sup>14</sup>

Irregularities in the floors and walls of the UANs were also verified. These same structures were neither impermeable nor washable and were not found in a good state of repair. A situation similar to this was observed by Silva, Germano and Germano<sup>15</sup> in a study conducted in the public schools in the state of São Paulo, in which 50% of the schools presented floors and walls in poor condition.

According to RDC 216/2004, the lamps and lighting fixtures localized above the food preparation area should be protected against possible explosions and accidental falls. Following this resolution, the nonexistence of fans with airflow focused directly over the food must be guaranteed.<sup>14</sup> None of the schools had lamps adorned with a security system against accidental falls, and only one of them guaranteed the absence of fans in the handling areas.

In accordance with RDC 216/2004, the sinks should be exclusively for the sanitation of hands, possess odorless liquid antiseptic soap, non-recycled paper towels or another hygienic and safe system of hand drying, and a paper collector that can be used without manual contact.<sup>11</sup> Hand washing, if performed properly and with the necessary frequency, is one of the most important measures in diminishing the quantity of microorganisms that contact the food, reducing the chance of possible food contamination. There were no sinks exclusively for the collab-

orators to use for hand sanitation in the handling areas during food production, in any of the schools.<sup>16</sup>

The largest non-conformity observed in the temperature controlled storage area was the absence of thermometers for temperature control in the refrigeration and freezing equipment, which made the guarantee of ideal food storage temperatures impossible to determine. According to Colombo, Oliveira and Silva, refrigerators must remain at a temperature of 5 °C or lower to reduce the speed of bacterial growth and the development of food borne diseases in the food. The ideal temperature for freezers, approximately 18 °C below zero or lower, halts bacterial growth, while even killing some pathogenic bacteria.<sup>17</sup>

The lack of temperature control in refrigerators and freezers could contribute to the development of microorganisms due to inadequate storage temperatures,<sup>18</sup> as well as the accumulation of ice and/or obstruction in these appliances. These conditions were verified through the application of the *check-list*.

The handlers of food are, for the most part, the main factor in food contamination, since they are in constant and direct contact with the food and many times do not practice the proper sanitation procedures. The correct application of the BPF provides a reduction in cross contamination by food handlers.<sup>17</sup>

The uniforms used by the handlers should be adequate, complete and duly clean in order to avoid cross contamination. Handler's shoes must be closed-toed, impermeable, and in good condition.

Adornments, such as rings, earrings, and bracelets, should not be used by handlers during work. This is due to the high probability of these adornments not being duly sanitized, presenting a danger of contamination; that they may come loose and fall into the preparations and that they may be risk factors to personal safety and to the integrity of the equipment and preparations. This demand was not being fulfilled in any of the schools.

It is important to emphasize the necessity of conducting regular medical examinations on the food handlers, since even those who appear healthy possess bacteria on the skin, and in the mouth, nose and intestinal tract, which can contaminate food.<sup>19</sup>

In all of the schools, there were food handlers that had not gone through any kind of food safety training. According to Oliveira, Brazil and Taddei,<sup>14</sup> one of the main problems in an institution's food production unit is the absence of training for food handlers. It is necessary that food handlers participate in relevant training programs and courses so that they can better understand how to apply BPFs to insure that sanitary meals are produced and food borne diseases are not transmitted. The RDC 216/2004 determines that handlers be trained regularly in personal hygiene, hygienic handling of the foods, and in disease transmission by foods, and that the training be documented.<sup>11</sup>

Machado, Monego and Campos<sup>20</sup> concluded in their study that it is necessary to change the production management of the meals in order to reduce health risks, monitor the hygienic practices of the handlers during the production of food and train them “in a constructive manner”.

Among the duties of nutritionists responsible for PNAE, is the training of professionals that act directly in the execution of the program. In this way, it is the responsibility of the nutritionist to offer the necessary training, which will require the participation of the handlers.<sup>12</sup>

In relation to the receipt of raw material, the legislation determines that its general conditions, packaging integrity and the temperature of the food that requires special storage conditions, be verified.<sup>11</sup> The temperature of the food was not verified in any of the schools due to a lack of the specific equipment needed, which could result in the receipt of products at an incorrect storage temperature.

The correct sanitation of the hands on the part of the food handlers is one of the main requirements in the prevention of DTAs. The handlers should sanitize their hands in the following manner: wet the hands and forearms with water; wash them with neutral, odorless, liquid soap; wipe well and dry them with a non-recycled paper towel or through any other form of drying that does not permit the recontamination of the hands, always when arriving at work, after touching contaminated materials, after using the bathroom, and whenever else it is needed. In the study by Oliveira, Brazil and Taddei,<sup>14</sup> it was observed that 87.5% of the food handlers did not use the correct hand washing technique.

The sanitation of vegetables and fruits should be by immersion in bleach, or other sanitizer, for a period of 10 to 15 minutes, favoring the reduction of pathogenic microorganisms, thus diminishing the health risk to the students.<sup>4</sup> Oliveira, Brazil and Taddei<sup>14</sup> found in their study that 80% of the evaluated day-cares did not practice adequate procedures for food disinfection in the pre-preparation phase.

All food services should possess the Good Practices Manual and practice the standard operational procedures. These documents should be easily accessible to all those involved in food service, and they should be available to the sanitation authorities when solicited. None of the schools were in possession of the Good Practices Manual and none of the four mandatory Standard Operational Procedures (POP) (Sanitation of installations, equipments and furniture; integrated control of urban vectors and pests; Sanitation of the reservoir; Sanitation and health of the handlers) were accessible to the food handlers.

According to RDC n° 275/02, the Good Manufacturing Practices Manual should describe the operations that are done by the UAN, including at least the sanitation requisites of the building, the maintenance and sanitation of the installation, the

equipment, and the utensils, the control of the water supply, the integrated control of urban vectors and pests, the control of the hygiene and health of the handlers, and the control and guarantee of the final product quality. The POPs can be annexed to the Good Manufacturing Practices Manual and should be monitored regularly to guarantee their purpose.<sup>21</sup>

All establishments should post upright containers, easily cleanable, adorned with lids liftable without the use of hands for the ridding of waste. These units should be frequently collected and stored in locations isolated from the handling area.<sup>1</sup> The improper management of waste is a troubling factor, as it compromises environmental hygiene and exposes the students to risks, due to the proliferation of pests and vectors in the school environment.<sup>22</sup> All locations that offer feeding services should be free from vectors and pests, effecting efficient actions that impede the attraction, shelter and proliferation of them.<sup>1</sup>

Environmental sanitation can be done in an adequate form using water, soap, and disinfectant for 15 minutes, drying the area immediately afterwards, or through heat disinfection (hot water) for 15 minutes.<sup>16</sup> The food preparation areas should be sanitized correctly after finishing activities and always when necessary. The practice of sweeping a dry floor is prohibited to avoid the dispersal of dust.

The correct disinfection of equipments and utensils includes the use of chlorine solution for at least 15 minutes and/or the use of alcohol 70.<sup>16</sup> A study in the state schools from the state of Maranhão demonstrated that the equipment and utensils are used in sub-standard cleanliness and sanitation conditions.<sup>23</sup> According to Oliveira, Brazile, Taddei,<sup>14</sup> the state of conservation and the function of the equipment and utensils, as well as their condition of cleanliness, influence the final quality of a produced food.

The use of non-discardable cloths in the sanitizing and drying of the utensils, equipments and other surfaces that enter into direct contact with food is not permitted, for the cloths work as a vehicle of contamination, augmenting the risk of cross contamination.<sup>24</sup> In a study by Cardoso, et al. the use of cloth towels was a practice used in all of the schools that were visited.<sup>22</sup>

## CONCLUSION

From the results obtained in this study, it was observed that the main problems in the school feeding production units in the children’s schools of Rio Branco – Acre are related to the inadequate physical structure and the incorrect handling of the food by the handlers involved in the production process. Another critical point that was observed was the incorrect practices relative to the personal hygiene of the food handlers and of the production environment.

So, it is important to highlight the importance of continued training about good manufacturing practices, administered

by capable professionals, the presence of nutritionists in sufficient quantities in order to supervise the process of production, and a restructuring of the physical space of the food production units, according to present legislation. These actions are necessary in order to ensure the distribution of high quality, safe and sanitary meals.

## AUTHORS CONTRIBUTIONS

Alanderson Alves Ramalho designed the study. All authors collected and analyzed the data under the supervision of Alanderson Alves Ramalho. Irla Maiara Silva Medeiros and Stefany Guerreiro Lima wrote the manuscript. All other authors revised the manuscript and contributed to the discussion of the results and revision of the intellectual content. All authors approved the final version of the manuscript.

## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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## CONSENT

The subjects (schools and food handlers) were informed about the purpose of the study and informed consent was obtained.

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