OCCUPATIONAL ACCIDENTS AND DISEASES IN BRAZILIAN SLAUGHTERHOUSES: A NATIONAL OVERVIEW

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Abstract

Agribusiness is on the rise in Brazil, and the slaughter and meat products manufacturing sector occupies a prominent position in exports. However, epidemiological studies on occupational accidents in this sector are scarce. This cross-sectional observational epidemiological study aimed to analyze the national panorama of occupational accidents and diseases in the slaughter and meat products manufacturing sector in Brazil. The variables: total occupational accident (ATT), occupational disease (DT), occupational accident (AT) without Communication of Occupational Accident (CAT) and the number of workers in each National Classification of Economic Activity (CNAE) were extracted from the Statistical Yearbook of Occupational Accidents (AEAT) and the Annual Report of Social Information (RAIS) of each CNAE in 2019. The slaughter and meat products manufacturing sector caused 62 ATT and 6.65 underreported AT daily. In absolute numbers, this sector ranked 3rd in ATT (22,757), 2nd in DT (697) and 4th in underreporting of AT in Brazil (2,429; 10.7%). The activity of slaughtering swine, poultry and small animals (CNAE 1012) was the leader in the sector, ranking 5th nationally in number of ATT (12,474), 2nd in DT (541) and 7th in AT without CAT (1,489; 11.9% underreporting). However, the activity of slaughtering cattle, except swine (CNAE 1011) was the one with the highest prevalence of ATT (5.62%) among the activities of this sector (5th in the national ranking) and CNAE 1012 of DT (0.1698%) (14th in the national ranking).

Keywords: Slaughterhouses; Work accident; Underreporting.

1. INTRODUCTION

From June 2016, a major television advertising campaign (Agro: the industry-wealth of Brazil) began to be aired in order to present the Brazilian agricultural activity and its relations with other sectors of society, aiming to create empathy, build and reinforce a positive image of agribusiness among the population (COSTA; OLIVEIRA, 2021). However, questions about the effects of agriculture on the emission of greenhouse gases, which would cause global warming and, consequently, climate change, have been raised. In addition, there is criticism of the

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Brazilian parliament's speeches on the denial of responsibility for socio-environmental damage to the agricultural sector (FRANÇA *et al*., 2021).

In Brazil, the slaughter and meat products manufacturing sector was the leader in poultry exports (ABPA, 2020) and cattle (ABIEC, 2020) and the fourth in pigs (ABPA, 2020) in 2019, slaughtering millions of head of animals per day. Slaughterhouses employ thousands of workers, who are subjected to several occupational hazards simultaneously. Studies in slaughterhouses have proven that the pace of work was high (REIS *et al*., 2017; 2020), the temperature of the workers' fingers was below 15 C° (TIRLONI *et al*., 2021; 2018), there was a significant increase in the risk of developing Work-Related Musculoskeletal Disorders (WMSD) when the knives were poorly sharpened (TIRLONI, *et al*., 2020a) and manual cargo transport was carried out in inadequate conditions and with a volume/day above that recommended for a worker (TIRLONI, *et al.,* 2020b, 2020c).

The slaughtering and manufacturing of meat products sector is considered to be of medium risk, according to the table presented in Regulatory Standard NR-4 (BRASIL, 1978), therefore, the contribution rate regarding the Occupational Environmental Risks (RAT) of these companies is 3% (BRASIL, 2021). Depending on the company's performance in relation to occupational accidents that occurred in a given period, this percentage can be decreased or increased by applying the Accident Prevention Factor (FAP) (BRASIL, 2021a).

The importance of the slaughterhouse sector in the generation of jobs and income in Brazil is evident, but how much is this reflected in registered work accidents? An occupational accident is one that occurs due to the exercise of work in the service of a company or domestic employer or by the exercise of the work of the insured, causing bodily injury or functional disturbance that causes death or the loss or reduction, permanent or temporary, of the capacity to work (BRASIL, 1991). According to the Observatory of Safety and Health at Work (SMARTLAB, 2021), in 2018 there were 623.8 thousand total occupational accidents (ATT) and 154.2 thousand accidents without CAT, the estimate of underreporting of occupational accidents (without Communication of Occupational Accidents – CAT) in Brazil was 24.7%.

As the notification of TA causes a financial burden to companies, it is assumed that underreporting of these companies occurs. In addition, another cause of underreporting of OA is the existence of several official and public registration systems in Brazil, as found in the study by Rodrigues and Santana (2019).

The Regulatory Impact Analysis (RIA) of Regulatory Standard No. 17 – Ergonomics (NR-17) mentions the occurrence of underreporting in Brazil. In addition to mentioning that

the events recorded represent only a small sample of the total number of accidents, as they do not refer to all workers, being restricted to those insured under the General Social Security Regime (RGPS) (BRASIL, 2021b).

Epidemiological studies on OA in the slaughterhouse and meat product manufacturing sector are scarce, and only one specific research was found in a poultry slaughterhouse (TAKEDA *et al*., 2018). Thus, the objective of this study was to analyze the national panorama of accidents and occupational diseases in the slaughtering and manufacturing of meat products sector in Brazil.

2. DEVELOPMENT

2.1. Method

This is a cross-sectional, prevalence, population-based observational epidemiological study, as it represents all workers in Brazil, registered in the RAIS for the year 2019. This year it was selected because it represented the panorama of occupational accidents in Brazil before the pandemic caused by the new coronavirus SARS-COV-2.

The numbers of total occupational accidents (RTA) (sum of OA with and without registered CAT) of each National Classification of Economic Activity (CNAE) were extracted from the 2019 Statistical Yearbook of Occupational Accidents (AEAT) (AEAT, 2019). The number of OA with CAT recorded includes accidents by reason: typical, commuting and occupational disease (TD). In the present study, the absolute numbers of RTA, TD and TA without CAT were analyzed. The CNAE is a hierarchical classification in five levels – sections (letter), divisions, groups, classes and subclasses (numbers). In the present study, the section of interest was the processing industry (C), the division was the manufacture of food products (10) and the group "Slaughtering and manufacture of meat products" (10.1). Each division has one or more groups of economic activities and each group has one or more classes. The economic group for the slaughter and manufacture of meat products is formed by the classes with the following codes: CNAE 1011 - Slaughter of cattle, except pigs; 1012 - Slaughter of pigs, poultry and other small animals and 1013 - Manufacture of meat products. The subclasses, which correspond to the breakdown of the classes, were not addressed in this study.

The number of RTA, TD and TA without CAT of the classes of each division and group were summed and organized in spreadsheets, to be later arranged in descending order. Two economic classes were excluded from the analyses, the variable mentioned in the AEAT as "ignored", as this classification represented the sum of several CNAE. CNAE 7010 -

"Headquarters of companies and local administrative units" was also not part of the study, as it presented divergent information, such as the presence of 4 ATT and no worker linked to this CNAE. Thus, 87 divisions, 281 groups and 668 classes of economic activities were part of the analyses

To determine the percentage of underreporting of OA in Brazil, in the slaughter sector and in each CNAE of this economic group, the same calculation used in the Observatory of Occupational Safety and Health (SMARTLAB, 2021) was carried out, the percentage of OA without CAT was calculated in relation to the total amount of OA.

In order to verify the prevalence of WA and TD, the number of workers in each CNAE in 2019 was extracted from the microdata of the Annual Report of Social Information (RAIS) available on the Ministry of Labor (MTE) website, in an open way, through the Program for the Dissemination of Labor Statistics (PDET) (BRASIL, 2021c). The prevalence of WA and TD was ranked with the CNAE that had at least 1,000 workers linked to the contract.

2.2. Findings

In Brazil in 2019, there were 582,507 total occupational accidents, of which, 374,545 were recorded as typical OA, 102,213 commuting, 9,352 occupational diseases and 96,397 OA without the issuance of CAT. Brazil employed 47,554,211 workers, while the group of "Slaughtering and manufacture of meat products" employed 522,741 workers (1.09%) and accounted for in its three CNAE (1011, 1012 and 1013), 22,757 total occupational accidents, 697 occupational diseases and 2,429 occupational accidents without CAT (Table 1); 3.9%, 7.45% and 2.51% in relation to the total values of occurrences in the country, respectively. It was identified that the number of illnesses registered in Brazil corresponded to 1.60% of the RTA and in the slaughterhouse sector it was almost double, 3.06%. It was found that in 2019 (365 days), this sector caused 62 OA or TD per day and underreporting was 6.65 RTA daily.

Analyzing by CNAE division, the results showed that the manufacture of food products (Division 10) employed 1,594,827 workers, occupied the third position in the RTA ranking (43,853) and the second in DT (961) and TA without CAT (4,828). Similar positions were found for the CNAE 10.1 group (Slaughter and manufacture of meat products) in relation to TA and TD (Table 1). On the other hand, among the 281 groups of economic activities, the slaughterhouse sector was the fourth that most failed to issue CAT in 2019. The sector represented 51.9% of the RTA, 72.5% of the TD and 50.3% of the WA without CAT granted to workers in companies that manufactured food products (Division 10). In addition, it was

found that the slaughtering and manufacturing of meat products sector employed 36.52% of the workers in this economic division.

Table 1. Presentation of the groups of economic activities with the highest absolute numbers of occupational accidents and diseases and occupational accidents without CAT in 2019

Ranking	CNAE Group	Total ATT (n)	CNAE Group	Total de DT	CNAE Group	Total TA without CAT
1	86.1	56.922	64.2	1.876	84.1	3.784
2	47.1	27.315	**10.1**	**697**	86.1	3.160
3	**10.1**	**22.757**	86.1	465	47.1	3.128
4	84.1	18.065	53.1	431	**10.1**	**2.429**
5	49.3	13.808	29.4	274	49.2	2.243
6	56.1	10.698	47.1	188	64.2	2.233
7	41.2	9.423	29.1	170	49.3	1.808
8	53.1	8.536	84.1	148	81.2	1.627
9	38.1	8.032	49.3	121	41.2	1.456
10	22.2	7.962	56.1	118	80.1	1.177

n = 281 CNAE groups; description of the groups of economic activities: **10.1 – Slaughter and manufacture of meat products;** 22.2 - Manufacture of plastic products; 29.1 - Manufacture of automobiles, vans and utility vehicles; 29.4 - Manufacture of parts and accessories for motor vehicles; 38.1 - Waste collection; 41.2 - Construction of buildings; 47.1 - Non-specialized retail trade - hypermarkets and supermarkets; 49.2 - Road passenger transport; 49.3 - Road freight transport; 53.1 - Mail activities; 56.1 - Restaurants and other food and beverage services; 64.2 - Monetary intermediation - demand deposits; 80.1 - Surveillance, private security and transportation of valuables activities; 81.2 - Cleaning activities; 84.1- Administration of the state and economic and social policy; 86.1 - Hospital care activities.

Table 2 shows the ranking of the first 10 CNAE classes referring to the absolute numbers of occupational accidents and diseases and accidents without CAT, according to AEAT 2019.

Table 2. Absolute numbers of occupational accidents and diseases and occupational accidents without recorded CAT

Ranking	Total accidents at work		Occupational Diseases		Occupational accidents without a registered CAT	
	CNAE	n	CNAE	n	CNAE	n
1	8610	56.922	6422	1.772	8411	3.728
2	4711	24.278	**1012**	**541**	8610	3.160
3	8411	17.471	8610	465	4711	2.882
4	4930	13.808	5310	431	6422	2.011
5	**1012**	**12.474**	2910	170	4921	1.868
6	5611	10.659	4711	143	4930	1.808
7	4120	9.423	8411	141	**1012**	**1.489**
8	5310	8.536	**1011**	**130**	4120	1.456
9	3811	7.827	4930	121	8121	1.429
10	**1011**	**7.718**	5611	117	8220	1.036

n = 668 CNAE; description of the classes of economic activities: **1011 - Slaughter of cattle, except pigs; 1012 - Slaughter of pigs, poultry and other small animals;** 2910 - Manufacture of automobiles, vans and SUVs; 3811 - Collection of non-hazardous waste; 4120 - Construction of buildings; 4711 - Retail trade of goods in

general, with predominance of food products - hypermarkets and supermarkets; 4921 - Collective road transport of passengers, with fixed route, municipal and metropolitan region; 4930 - Road transport of cargo; 5310 - Postal activities; 5611 - Restaurants and other establishments of food and beverage services; 6422 - Multiple banks, with a commercial portfolio; 8121- Cleaning in buildings and homes; 8220 - Teleservice activities; 8411 - Public administration in general; 8610 - Hospital care activities.

Based on Table 2, it was found that CNAES 1011 and 1012 are among the ten activities with the highest absolute number of RTA (7,718 and 12,474, respectively) and among the eight with the highest TD (130 and 541, respectively).

According to the data declared, the underreporting of occupational accidents in Brazil in 2019 was 16.5% and in the slaughtering and manufacturing of meat products sector it was 10.7%. CNAE 1012 was the seventh activity that presented the most TA without CAT registered (1,489) and the one that most underreported in the slaughterhouse sector (11.9%). CNAE 1011 had 743 OA without CAT, an underreporting of 9.6%. It is noteworthy that CNAE 1013 presented 2,565 RTA, 26 TD and 197 OA without CAT, 7.7% of underreporting of OA, and in absolute numbers, it occupied the 40th, 45th and 49th positions in the national ranking, respectively. Table 3 shows the prevalence of occupational accidents and diseases in 2019.

Table 3. Prevalence of occupational accidents and diseases of all economic activities in Brazil in 2019.

Rank	Occupational accidents				Occupational Diseases			
	CNAE	Work	Total ATT	Prevalence	CNAE	Work	Total DT	Prevalence
1	0141	14.873	2.241	15,07	6422	370.199	1.772	0,4787
2	2451	40.225	4.450	11,06	2942	10.546	46	0,4362
3	5310	132.772	8.536	6,43	2831	5.891	24	0,4074
4	3811	131.710	7.827	5,94	5310	132.772	431	0,3246
5	**1011**	**137.308**	**7.718**	**5,62**	3031	2.466	7	0,2839
6	1082	2.591	143	5,52	3316	9.799	25	0,2551
7	3822	5.370	296	5,51	2622	21.156	50	0,2363
8	2930	45.956	2.309	5,02	3091	14.002	33	0,2357
9	1623	13.067	634	4,85	2531	4.695	11	0,2343
10	0500	3.607	174	4,82	3012	2.597	6	0,2310
11	2531	4.695	223	4,75	2910	80.742	170	0,2105
12	8610	1.254.829	56.922	4,54	3099	3.364	7	0,2081
13	1210	3.974	176	4,43	2943	13.860	26	0,1876
14	1932	3.355	148	4,41	**1012**	**318.519**	**541**	**0,1698**
15	1322	1.349	57	4,23	0710	54.445	92	0,1690
16	2942	10.546	433	4,11	2853	5.481	9	0,1642
17	2311	17.813	731	4,10	3011	16.039	24	0,1496
18	**1012**	**318.519**	**12.474**	**3,92**	2443	4.870	7	0,1437

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19	4912	35.830	1.393	3,89	2211	28.081	40	0,1424
20	2411	10.921	423	3,87	2941	35.231	48	0,1362
21	**1013**	**66.914**	**2.565**	**3,83**	0141	14.873	20	0,1345

n = 668 CNAE; description of the classes of economic activities: 0141 - Production of certified seeds; 0710 - Extraction of iron ore; **1011 - Slaughter of cattle, except pigs; 1012 - Slaughter of pigs, poultry and other small animals; 1013 - Manufacture of meat products;** 2211 - Manufacture of tyres and inner tubes; 2443 - Copper metallurgy; 2531 - Production of steel forgings and non-ferrous metals and their alloys; 2622 - Manufacture of peripherals for computer equipment; 2831 - Manufacture of agricultural tractors; 2853 - Manufacture of tractors, except agricultural; 2910 - Manufacture of automobiles, vans and utility vehicles; 2941 - Manufacture of parts and accessories for the motor system of motor vehicles; 2942 - Manufacture of parts and accessories for the running and transmission systems of motor vehicles; 2943 - Manufacture of parts and accessories for the brake system of motor vehicles; 3011 - Construction of vessels and floating structures; 3012 - Construction of boats for sports and leisure; 3031 - Manufacture of locomotives, wagons and other rolling stock; 3091 - Manufacture of motorcycles; 3099 - Manufacture of transportation equipment not previously specified; 3316 - Maintenance and repair of aircraft; 3811 - Collection of non-hazardous waste; 5310 - Postal activities; 6422 - Multiple banks, with a commercial portfolio; 8610 - Hospital care activities.

Evaluating the economic activities with at least 1,000 workers linked to the contract, it was found that the slaughtering and manufacturing of meat products sector was among the 21 activities with the highest prevalence of RTA (Table 3), with CNAE 1011 being the most prevalent (5.62%; 5th position), followed by 1012 (3.92%; 18th position) and 1013 (3.83%; 21st position).

The prevalence of RTA in this sector was 4.35%, TD was 0.133% and underreporting of RTA was 0.465%. This means that for every 10,000 slaughterhouse workers, 435 had an occupational accident and 13.3 had an occupational disease, 46.5 had OA without CAT in 2019.

The activity of slaughtering pigs, poultry and other small animals was the 14th economic activity that caused the most occupational diseases in Brazil, with a prevalence of 0.1698%, leading the group of slaughter and manufacture of meat products.

2.3. Discussion

It is specified in the law that occupational or occupational disease is equivalent to an occupational accident, thus understood as inherent or peculiar to a certain branch of activity and contained in a list organized by the Ministry of Social Security and Social Assistance (MPAS) (BRASIL, 1976). However, according to the AIR (BRASIL, 2021), work-related diseases are possibly underreported, since they represent 2% of accidents from 2016 to 2019, which may lead to distortions in the data. The present study found similar results, as 1.6% and 3.06% of RTAs were occupational diseases in Brazil (all sectors) and in the slaughterhouse sector, respectively.

Several factors can interfere with underreporting. As evidenced by Rodrigues and Santana (2019) in the city of Palmas – Tocantins (TO) from 2007 to 2015, cases of deaths due to work-related accidents were not simultaneously recorded by all official and publicly accessible data systems, which led to underreporting of OA. Another issue is that the TA refer only to workers registered as insured by the RGPS, covering exclusively a portion of the working population (BRASIL, 2021). In addition, due to the relationship between AT and the payment of Occupational Accident Insurance (SAT) by companies, in which the rate of 1 to 3% may be reduced or increased, according to the company's performance. The change in the rate occurs from the application of a multiplier (FAP - Accident Prevention Factor) defined from the severity, frequency and cost indexes of each company (BRASIL, 2009). The trend towards underreporting is clear, because when analyzing Decree No. 6,957, it is found that to determine the severity index, all cases of sickness benefit, accident benefit, disability retirement and death pension, all of an accident nature, should be considered. Likewise for the calculation of the frequency index, the records of accidents and occupational diseases reported to the INSS by means of CAT and accident benefits established by technical nexuses (NTEP) by the INSS medical expertise, even if without CAT linked to them, will be considered. And finally, the cost index, which calculates the amounts of benefits of an accident nature paid or owed by Social Security.

According to the results of the present study, the underreporting of OA in the slaughter and meat products manufacturing sector is lower than the overall percentage in Brazil in 2019. On the other hand, the slaughter sector of pigs, poultry and small animals is larger, in addition to being the activity of the sector that causes the most occupational diseases. This fact can be explained, as studies have shown that the averages of repetitive actions per minute of poultry slaughterhouse workers were 64.4 ± 16.1 per minute (Reis *et al*., 2017), 69.1 ± 13.3 (TIRLONI *et al*., 2020a) and 77.0 ± 22.5 (Reis *et al*., 2020), considered high frequencies (COLOMBINI *et al*., 2008). Kilbom (1994) states that a job is repetitive if the duration of the work cycle is less than 30s and that the frequency range of 25-33 movements per minute should not be exceeded in order to prevent tendinitis.

The underreporting of TD in this sector is evident, given that there are several risk factors present in poultry slaughterhouses. According to OSHA (2013), the repetitiveness, force, inappropriate and static postures and vibrations, added to the cold work environment, potentiate the development of WMSD. A study carried out with 925 workers from three Brazilian poultry slaughterhouses revealed that the chance of a worker who felt cold having some musculoskeletal discomfort was twice as high as a worker who did not feel cold. Overall,

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71.5% of these workers felt some musculoskeletal discomfort and 59.2% felt cold (Tirloni *et al*., 2019).

In a historical series from 2002-2019, the worst prevalence of occupational accidents in Brazil was in 2008, with 242 cases per 10,000 formal workers, and in 2019, there were 164 cases registered (SMARTLAB, 2021), a prevalence of 1.64. In the present study, a prevalence of RTA almost three times higher than this was found in the slaughter and manufacture of meat products sector (4.35%), with the activity of slaughtering cattle, except pigs, being the most prevalent in the sector (5.62%). Studies prove that in cattle slaughterhouses, the strength requirement is high, as workers carried out manual transport of cargo with parts (animal room) ranging from 50.3 kg to 76 kg and the individual cumulative mass handled daily was greater than 10 tons (TIRLONI, *et al.,* 2020b). In another study, it was found that the mass of the manipulated object for men was not more than 25kg, however, the daily cumulative mass per worker was 35,333 kg. In addition, each worker transported 2,848 boxes per day, a pick-up frequency of 6.3 per min, resulting in a variable pick-up rate of 4.99 (very high) (TIRLONI, *et al.,* 2020c).

There are several conditions of risk of accidents and occupational diseases present in slaughterhouses. The sector-specific regulatory standard (NR-36) highlights several activities and conditions that can cause occupational accidents, such as the processing of animals, especially large and medium-sized ones, and the maintenance and hygiene of machinery and equipment. Furthermore, it recommends that the electrical installations of machinery and equipment must be designed and maintained in such a way as to prevent, by safe means, the risks of electric shock and all other types of accidents; also accidents due to ammonia leakage and the exposure of workers to biological agents (BRASIL, 2013).

3. CONCLUSION

The group of economic activities of slaughtering and manufacturing of meat products employed more than a third of the workers who manufactured food products in Brazil. In 2019, the slaughterhouse sector ranked third in absolute numbers of total occupational accidents, second in occupational diseases and fourth in cases of accidents without CAT registered in the country.

The activity of slaughtering pigs, poultry and other small animals was the fifth in the national ranking in relation to the absolute number of total occupational accidents, second in

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occupational diseases and the seventh in cases of accidents without CAT recorded. Underreporting in this activity was higher than in other slaughterhouse activities.

From another perspective, of the three CNAE of group 10.1, the slaughter of cattle, except pigs, was the most prevalent in total occupational accidents, on the other hand, the activity of slaughtering poultry, pigs and other small animals was the most prevalent in occupational diseases. Despite the evident underreporting of occupational diseases, the percentage of these in slaughterhouses was almost double the percentage of diseases registered in Brazil in 2019.

The results of the present study show how much the slaughterhouse sector stands out not only in exports, but also in the ranking of accidents and occupational diseases and in underreporting of accidents in relation to other economic activities, even though it has a specific regulatory standard for the sector. In view of the above, it is recommended that inspection actions should be intensified and not precarious, as workers' health is a constitutional right. Therefore, more public and private preventive interventions are needed in order to reduce the risks inherent to this work, avoiding the occurrence of accidents and damage to the health of these workers.

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