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Original article

Rest Break Frequency and Duration: Self-Reported Preference of Brazilian Poultry Slaughterhouse Workers

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ABSTRACT

The work pace in poultry slaughterhouses is high and the risk of developing upper limb work-related musculoskeletal disorders is moderate to high. Thus, through risk management and the use of technical, organizational, and administrative means, the employer should ensure the well-being of workers, as well as safe and healthy working environments and conditions. The aim of this study was to identify the self-reported preference of poultry slaughterhouse workers regarding rest break frequency and duration, and to verify the reasons for their choice. The participants in the study included 311 workers from four poultry slaughterhouses. The workers were asked what rest break schemes they preferred: 6x10 min, 3x20 min, 4x15 min or another schedule, as well as the reasons for their selection. According to the workers' opinions, 3x20 min was the best break schedule (90.7%), mainly because it allowed time to rest (64.5%), as they had more time to carry out their activities calmly. Unanimously, these workers responded that a 10-min break is very short, which only allows one to reach the rest area or the bathroom and return, no time to rest. Only 8.7% of workers wanted to have a higher rest break frequency (6 or 4 times per day) to leave the sector more, go to the bathroom often, have shorter work intervals, in addition to warming up the body and resting more. This paper provides guidelines for slaughterhouse managers to determine the best rest break schedules for their workers to promote health and safety.

INTRODUCTION

Many poultry processing jobs are physically demanding and involve factors that increase the risk of developing upper limb work-related musculoskeletal disorders (UL-WMSDs), one of them is repetition (OSHA, 2013). Studies have found that the work pace in poultry slaughterhouses is high (Reis *et al.*, 2017; 2020), because workers perform on average more than 60 technical actions/min (Colombini *et al.*, 2014). Nevertheless, global analyses identified that in most poultry slaughterhouses, the task risks were high (Reis *et al.*, 2015a) or moderate (Reis *et al.*, 2015b; 2016; 2017). Furthermore, papers confirm that when analyzing most tasks in slaughterhouses, the work pace was entirely determined by machines (68% and 97%) (Dias *et al.*, 2019; 2020).

The effects of the working conditions to which slaughterhouse workers were subjected were evidenced. One research carried out in three poultry slaughterhouses showed that most workers felt musculoskeletal discomfort (Tirloni *et al.*, 2019a). This survey was performed before the publication of Regulatory Standard 36 (NR-36) that sets out the minimum requirements for evaluation, control, and

monitoring of risks in tasks performed in Brazilian meat processing industries (Brasil, 2013). However, post-NR36 studies continue revealing the presence of musculoskeletal discomfort, but specifically in the upper limbs in 42.7% (Tirloni *et al.*, 2018) and 54% (Tirloni *et al.*, 2019b) of the poultry slaughterhouse workers investigated.

Brazil stands out worldwide due to the large volumes of meat production and exports, and nationally, for employing thousands of workers (ABPA, 2020). Besides, according to the latest Brazilian social security report of 2019, among 670 economic sectors, the slaughter and processing sector of pig, poultry and small animals is ranked the fifth highestin absolute numbers of occupational accidents and the second highest in illnesses (Brasil, 2019). Even before NR-36, the labor ministry already advocated that in the current productive model of slaughterhouses, several measures should be implemented to protect the health of workers in the sector (Sardá *et al.*, 2009). Slaughterhouses should comply with the requirements of NR-36 to permanently guarantee the safety, health, and quality of life at work, one of which is the implementation of psychophysiological and thermal pauses (Brasil, 2013), highlighting that the thermal pauses were already provided in art. 253 of the Consolidation of Labor Laws (CLT) (Brasil, 1943; 2012).

Rest breaks are important where highly paced, repetitive work is done and the scheduled breaks should be timed so that workers can rest before their arms or shoulders become fatigued (Harmse *et al.*, 2016).

The work-related injuries were significantly associated with long working hours (Lee *et al.*, 2020; Park *et al.*, 2020). With the mandatory implementation of daily breaks in all Brazilian slaughterhouses (total length of pauses per work shift of 20 to 60 min) (Brasil, 2013), the duration of repetitive work in a workday reduced, consequently diminished the time of risk exposure. Studies have stated that regular (Tucker, 2003) and non-regular (Yeow & Sen, 2004) pauses reduce the workers' fatigue. Nevertheless, a review study found that 46% of the surveys indicated that physical fatigue was the primary contributor to manufacturing quality deficits (Yung *et al.*, 2020). One analysis proved that workers who implemented pauses were less likely to feel discomfort in the upper limbs (Hembecker *et al.*, 2017).

The Occupational Repetitive Actions (OCRA) method has the recovery period (rest break) factor as one risk multiplier for the appearance of UL-WMSDs in its equation (Colombini & Occhipinti, 2017). It proposes that all working hours should be recovered with pauses of at least 8–10 consecutive minutes. Studies investigated the relationship between pause frequency and duration onset of work-related injury (Arlinghaus *et al.*, 2012; Lombardi *et al.*, 2014; Fisher *et al.*, 2017), as well as the effect of the distribution of breaks throughout the workday on the prevalence of UL-WMSDs in slaughterhouse workers (Dias *et al.*, 2021).

However, there is a lack of robust research that verifies the slaughterhouse workers' preference regarding the rest break schedules as well as the reasons for their choice. In this sense, only one study was found that determined the satisfaction degree concerning the psychophysiological recovery pauses among 45 workers of a chicken processing industry (Camargo, 2015).

Therefore, the purpose of this study was to identify the self-reported preference of poultry slaughterhouse workers related to the rest break frequency and duration, and to verify the reasons for their choice.

MATERIALS AND METHODS

This cross-sectional study was conducted in four Brazilian poultry slaughterhouses located in the states of Minas Gerais (1), Rio Grande do Sul (2) and Paraná (1); and approved by the Committee of Ethics in Research with Human Beings from the Federal University of Santa Catarina, under 2098/2011 Protocol. In all slaughterhouses, two work shifts (528 min each) occurred, where workers performed 453 min of repetitive work per workday, 3 x 20 min of rest breaks and 15 min for uniform change.

In the present study, only the employees from slaughterhouse n° 4 (S4) worked in artificially cold rooms (10 to 12 °C, sub-warm climatic zone), due to the requirements of exportation. Therefore, it was only necessary to perform thermal rest breaks (3 x 20 min) in this slaughterhouse (Table 1). Details about each slaughterhouse are described in Table 1, according to the information provided by the health and safety teams of the slaughterhouses.

Workers used a variety of personal protective equipment (PPE) for the hands (nitrile, chainmail, cut protection, thermal-protection, and polyethylene gloves), besides clothing, aprons, socks, and boots provided by the slaughterhouses with a Certificate of Approval from the Brazilian Ministry of Labor.

Table 1 – Descriptions of the Brazilian slaughterhouses.

Description	S1	S2	S3	S4
Total workers (n)	2,300	1,130	3,100	1,367
Workers in productive area	1,600	930	2,500	1,215
Chickens slaughtered daily	300,000	115,000	280,000	240,000
Climatic zones	Mesothermal	Mesothermal	Mesothermal	Sub-warm
Room temperatures	10 to 12 °C	10 to 12 °C	10 to 12 °C	10 to 12 °C
Rest break types	Psycho-physiological	Psycho-physiological	Psycho-physiological	Thermic
Participants of this study (n)	100	67	81	63

S –Slaughterhouse; considered artificially cold work environment: mesothermal< 10 °C, sub-warm < 12 °C; n=311 workers.

When starting a workday, slaughterhouse workers must register their entry time, change into their uniforms (dressing room) and go to their workstations. Figure 1 presents the daily work schedules of the four slaughterhouses (S1, S2, S3 and S4) obtained from the documents provided by the health and safety team of the plants.

Participants

The slaughterhouse selection was intentional, as well as the determination of the productive areas as the study's focus (due to the greater presence of ergonomic risks: work pace dictated by machines, cold environment and products, hand tool use, use of many overlapping gloves, noisy environment, pressure for results, etc.). However, the participants were selected randomly as follows, the first worker at the table or line was chosen, the next one was skipped, and the following was called, continuing in this alternating manner. Obeying the eligibility criteria, workers had already completed the 3-month training period and agreed to participate in the study. Participants in the current study included 311 workers (Table 1) from 15 sectors of the slaughterhouses, 10 from artificially cold environments and 5 from natural environments.

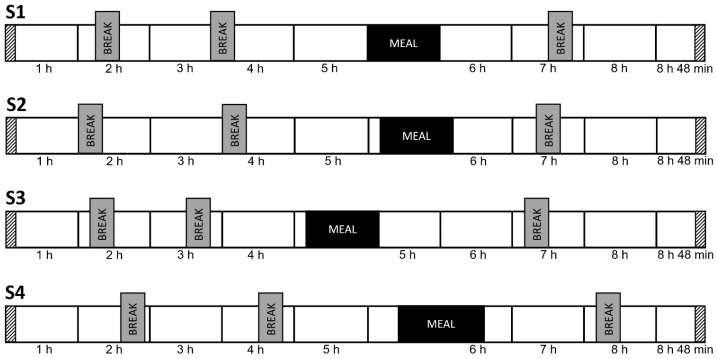

Figure 1 – Daily work schedule for each of the four slaughterhouses (S1, S2, S3 and S4): working time (white rectangles), time for changing into uniform and going to workstation (striped rectangle), rest breaks (grey rectangles) and meal (black rectangles).

Instruments

Workers were interviewed about identification data (age), work organization (time working at the slaughterhouse, hand tool use, number of gloves on both hands and job rotations), thermal sensation of cold in the hands and finally, which rest break schemes they preferred: 6 x 10 min, 3 x 20 min, 4 x 15 min or another schedule, along with the reasons for this choice (this question was descriptive).

Pause

Conforming to the climate map of Brazil (IBGE, 2002), the slaughterhouses surveyed were located in the mesothermal and sub-warm climatic zones. For these regions, the sectors with temperatures< 10 °C and < 12 °C, respectively (Table 1) are considered artificially cold work environments. Norm 36 establishes that workers who perform their activities in artificially cold environments and those who move goods from a hot or natural environment to the cold and vice versa, after 1h 40 min of continuous work, a minimum period of a 20-min rest break must be ensured (thermal rest break) (Brasil, 2013).This rest break schedule must occur outside the workplace (cold), in environments that offer thermal and acoustic comfort, with availability of benches or chairs and drinking water (Brasil, 2013).

Regarding psychophysiological pauses, the NR-36 mentions that for workers who directly carry out activities in the production process, that is, from reception to dispatch, where repetitive and/or static muscular or dynamic neck overload is required, shoulders, back and upper and lower limbs, pauses distributed according to Table 2 must be guaranteed (Brasil, 2013).

Table 2 – Minimum total duration of rest breaks in relation to a workday.

Workday duration	Total duration of rest breaks/workday
Up to 6 h20 min	20 min
Up to 7 h 40 min	45 min
Up to 9 h 10 min	60 min

Source: Brasil (2013).

Psychophysiological rest break duration can be a minimum of 10 min and a maximum of 20 min and must mandatorily occur outside the workstations,

with access to benches or chairs and drinking water (Brasil, 2013). When the temperature of the work environment demands the adoption of a thermal pause and a psychophysiological pause at the same time, there should be no cumulative application of breaks (Brasil, 2013).

The rest break distribution should not occur within the first hour of work, contiguous to the meal break, nor at the end of the last hour of the day (Brasil, 2013), as shown in Figures 1 and 2.

One method which provides criteria based on extensive epidemiological data, recommended by ISO 11228-3 - Handling of Low Loads at High Frequency (ISO, 2007) to estimate the occupational risk of UL-WMSDs in workers performing repetitive tasks (OCRA), makes different orientations of the rest break distribution in relation to NR-36.

The OCRA method analyzes the lack of recovery periods (Colombini & Occhipinti, 2017) and considers the actual recovery time, when one interruption in the repetitive work of the upper limbs lasts at least 8/10 min every hour (upper limbs inactive or other visual inspection tasks). Furthermore, there must be a ratio of 5:1 between work time and recovery time (Colombini & Occhipinti, 2017), this means that there should be a pause in the first hour of work, but after 50 min of repetitive tasks. This method considers the 60 min prior to the end of the work shift and before the meal break (lasting at least 30 min) as hour recovered (Colombini & Occhipinti, 2017).

Figure 2 shows the best example of psychophysiological pauses that completely meets the NR-36 recommendations and partially meets the OCRA method (due to a lack of a rest break in the first hour). Failure to accomplish this requirement (OCRA method) can increase the risk of developing WMSD by 5%. The rest intervals were distributed over an 8 h 48 min workday, 15 min for uniform change (8 min at the beginning of the workday and 7 min at the end –striped rectangle) with a 60-min meal.

Figure 2 – Distribution of psychophysiological rest breaks to simultaneously meet the NR-36 recommendations (Brasil, 2013) and the criteria of the OCRA method (Colombini & Occhipinti, 2017).

Statistical analysis

The data was analyzed using IBM SPSS Statistics, version 21.0 (IBM Corp., Armonk, NY, USA). The quantitative variables were expressed in average and standard deviation, and the categorical variables in frequency and percent. The choices of the work-rest schedules and the reasons cited by workers were evaluated and grouped into categories for further analysis.

RESULTS

Conforming to Table 3, most employees worked in the morning work shift, in an artificially cold environment, but most did not use a hand tool, perform a job rotation nor feel cold in their hands. Male workers were 32.6 ± 10.8 years old and female 33.5 ± 10.6 years, and the time working at the slaughterhouse was 4.3 ± 5.4 years, from 3 months to 32 years. As shown in Figure 1, the minimum and maximum work breaks were between 60 min and 138 min, respectively, with the longest working intervals after the main meal.

Table 3 – Sample and work organization characteristics.

Variables	n (%)	
Gender		
Male	140 (45)	
Female	171 (55)	
Work shift		
Morning	217 (69.8)	
Afternoon	94 (30.2)	
Work environment		
Artificially cold	253 (81.4)	
Natural	58 (18.6)	
Hand tool use		
No	189 (60.8)	
Yes	122 (39.2)	
Gloves	Hand	
	Non-dominant	Dominant
No	16 (5.1)	17 (5.5)
Yes	295 (94.9)	294 (94.5)
Number of gloves worn		
1	96 (30.9)	136 (43.7)
2	124 (39.9)	113 (36.3)
3	54 (17.4)	35 (11.3)
4	16 (5.1)	10 (3.2)
5	5 (1.6)	0 (0)
Job rotation		
No	170 (54.7)	
Yes – every day	100 (32.2)	
Yes – irregular	41 (13.1)	
Number of tasks		
1	170 (54.7)	
2	52 (16.7)	
3	39 (12.5)	
4	47 (15.1)	
7	3 (1.0)	
Felt cold in the hands		
No	210 (67.5)	
Yes	101 (32.5)	

n = 311 workers

Most workers preferred the 3 x 20 min rest break scheme (90.7%), mainly because it allowed them to rest (64.5%). For each preferred type of rest break schedule chosen, one or more reasons per worker were cited (Table 4).

It was observed that those who wanted to have a higher pause frequency, 6 and 4 times per day (8.7%) (Table 4), made this choice to leave the sector more, go to the bathroom often, have shorter work intervals, in addition to warming up the body and resting more. These workers mentioned that in the rest break schedule of 3 x 20 min, there was only one break after the main meal (lunch or dinner), which led to a long period without a break ("Sometimes it's 3 hours without stopping for a break.", said a worker). It was also mentioned that taking breaks was beneficial, but the distribution was not.

On the other hand, those who chose breaks of 3 x 20 min mentioned that in 20 min there was more time to do activities calmly, such as resting, having a snack, going to the bathroom, reaching the rest area and returning to the workstation, putting on and removing the PPE and warming up the body (Table 4).

Table 4 – Type of preferred rest break and reasons for their choice by workers.

Rest break frequency and duration	n (%)	Reasons	n (%)
6 x 10 min	5 (1.6)	Exit the sector	1 (20.0)
		Go to the bathroom	2 (40.0)
		Have shorter work intervals	3 (60.0)
4 x 15 min	22 (7.1)	Rest more	12 (54.5)
		Go to the bathroom	3 (13.6)
		Exit the sector	11 (50.0)
		Warm up the body	3 (13.6)
		Have shorter work intervals	8 (36.4)
3 x 20 min	282 (90.7)	Do the activities calmly	39 (13.8)
		Rest	182 (64.5)
		Go to the bathroom	76 (27.0)
		Put on and remove PPE	92 (32.6)
		Relocate calmly	30 (10.6)
		Exit the sector	2 (0.7)
		Warm up the body	4 (1.4)
		Snack	16 (5.7)
2 x 30 min	1 (0.3)	Rest	1 (100)
Indifferent	1 (0.3)	NR	1 (100)

*Data presents multiple responses for each rest break schedules; NR – Not Reported.

Unanimously, these workers responded that a 10-min rest break is very short, as it is only possible to arrive at the rest area or bathroom and return, so there is no time to rest. The quote "It is terrible to leave the workstation frequently and have to take off and put on the PPE in only 10 min." stands out. It was found that the minority of workers did not wear gloves, nevertheless, most of them wore two to five overlapping gloves (Table 3).

The workers mentioned that only moving from the workstation to the rest area or bathroom took 2 to 3 minutes (just going, excluding the time to remove the PPE), the location was far away, and they needed time to relocate calmly. In addition, in the analyzed slaughterhouses, there were 930 to 2,500 workers in the productive area, perhaps that is why the quotes are justified: "There are many workers who need to use the bathroom.", "There is a queue.", "There is chaos."

DISCUSSION

Researchers cited that the rest breaks help in the physiological recovery of workers (Kilbom, 1994; Tucker, 2003; Yeow & Sen, 2004; Brasil, 2013; Colombini & Occhipinti, 2017). Additionally, workers who did not perform pauses at work were 2.2 times more likely to experience upper-limb discomfort than those who executed them (Hembecker *et al.*, 2017). Conversely, Waongenngarm *et al.* (2018) revealed that low-quality evidence supported the effectiveness of breaks on preventing low back discomfort.

In the present study, all workers achieved rest breaks, but more than half did not perform job rotations, consequently, they carried out only one task in the work shift. Performing the same motion or series of motions continually or frequently is an Ergonomics-related risk factor that may lead to the development of WMSDs in poultry processing (OSHA, 2013). The rest breaks and job rotations can relieve fatigued muscles (AMI, 2013). Regular rest breaks can be an effective means of maintaining performance, managing fatigue, and controlling the accumulation of risks over prolonged task performance (Tucker *et al.*, 2003). In an intervention on a continuous production line, leaders were instructed to take over the line to allow operators short breaks whenever they felt tired. It resulted in a 28% decrease of fatigue in the upper extremities (Yeow & Sen, 2004).

In the current study, only one slaughterhouse had a lawful requirement to perform thermal rest breaks (3 x 20 min), that is, the others could take shorter breaks, however, they chose to take pauses of 20 min. Several factors may have interfered with the choice of a longer pause: the long distances from the workplace to the rest areas and bathrooms; the high number of workers employed in slaughterhouses; and the strict controls:

sanitary, quality and safety that require PPE use, the washing of boots and hands before entering the work sector, besides the safe movement of workers (walking, without disturbance).

In accordance to this study, Camargo (2015), states that 55% of the workers in a poultry slaughterhouse were satisfied with the 20-min breaks and disapproved the 10-min breaks. Workers claimed that they would be unable to rest in a 10-min break, since they spend a lot of time putting on and removing PPE. It is noteworthy that in this slaughterhouse, there were only 488 employees, and the rest area was centralized in the factory, with the fast arrival of workers for rest, unlike the reality of the slaughterhouses investigated in the current study (930 to 2,500 workers).

It is worth mentioning that the workers' non-compliance with the rest break duration can also impact the production flow, consequently generating bottlenecks. In the study by Camargo (2015), in which workers took breaks through rotations, 91% of workers were satisfied or very satisfied with the punctuality of their co-workers in taking breaks. Even with visible clocks in the rest areas, according to the requirement of NR-36 (Brasil, 2013), only 9% of workers were unsatisfied with their co-workers (Camargo, 2015). Nonetheless, this fact would need to be managed and improved by supervisors, so as not to cause stress to punctual workers. It should be noted that the breaks must be well distributed throughout the workday, the duration of the pre-determined work pauses must be respected by the production managers, and the worker must take advantage of all the rest breaks of a workday. According to Denadai *et al.* (2021), the success of training applied in their study was highly dependent on the content and approach of the training. For this reason, the theme "rest break frequency and duration" can be addressed in the initial and periodic training of slaughterhouse workers.

The NR-36 adverted that a rest break should not occur in the first hour of work (Brasil, 2013). Conforming to disabling claims data of 12,222 workers of the construction industry from 2007 to 2013, it was identified that the 5th and 13th hours corresponded to significantly more severe injuries and illnesses than in the first hour of work (Yang *et al.*, 2020). Some workers, in the current study, cited that they preferred a higher frequency of breaks so as not to work for long periods (after the main meal). This indicates the risk of working for many hours without a rest break, along with the aggravating factor that this occurred from the middle to the end of the workday.

The results of this study showed that 60% of workers did not use a knife and only 33% of workers felt cold in their hands. Perhaps for this reason, warming up the body and leaving the sector were cited less frequently. Research has revealed that most slaughterhouse workers felt cold (Tirloni *et al.*, 2012; Ramos *et al.*, 2015; 2017; 2018) and that the chance of feeling cold for a worker who used a tool was greater than for a worker who did not (OR = 3.19, 95% CI 1.46; 6.94) (Tirloni *et al.*, 2018). Degrading working conditions in an artificially cold environment were identified, as 66% of workers in a poultry slaughterhouse had at least one finger at ≤15 °C (Tirloni *et al.*, 2018). This finger temperature is considered high physiological stress, so it can only occur occasionally, as dexterity, strength and coordination could be affected, and the person may experience the sensation of pain (ISO, 2007). Moreover, almost all workers who used a hand tool had a finger temperature ≤ 24 °C (Ramos *et al.*, 2015, Tirloni *et al.* 2017), a condition that does not preserve and causes improper functioning of the hands/fingers (ISO, 2007), despite the existence of a more conservative parameter for this purpose (32 and 36 °C) (Vogt, 2001).

Chotiphan *et al.*, (2020) and Phanprasit *et al.* (2021) cited that the prevalence of cold-related pain in slaughterhouse workers exposed to cold environments can be prevented, with the use of appropriate clothing (more layers), decreased exposure time to cold environments, longer warming-up periods, hot drinks, and increasing awareness about the hazards of working in cold environments.

Evidence-based strategies that promote better sleep and optimize work/rest schedules can mitigate the impact of fatigue and sleep loss (Caldwell *et al.*, 2019). An investigation found that slaughterhouse workers may reside in cities more than 154 km away from the company (about 4h/day, round trip) (Ruiz *et al.*, 2017). These workers usually travel by bus and depending on the start time of the workday (2:30 to 5:00 a.m. in the present study), vehicles are chartered by the company. The residence of slaughterhouse workers may vary, as data proved that in one slaughterhouse, 55.1% of the workforce commuted from another city, and in the other slaughterhouse, 100% of workers resided in the city where the slaughterhouse was located (Ruiz *et al.*, 2017). This means that there are cases of workers who wake up early, travel up to 2 h, and still have an exhaustive work shift of 8h 48 min, then another trip of almost 2 hours to return home. Considering that the NR-36 does not recommend a break in the first hour

of work, the question is: "In what condition do these workers arrive at the company?" "Do they need to eat and have coffee to wake up before starting work?"

Still regarding the duration of continuous work (2h), it was revealed by the analysis of 1,954 employees that the longer time doing the job, the greater the relative risk (RR) of an accident. Adopting as a reference, the first 30 min of one work interval period (2h), the RR of an accident for the range of 30–59 min was 1.33 (95% CI 1.06–1.60); 60-89 min was 1.71 (95% CI 1.40–2.02); and in the last half-hour, it was 2.08 (95% CI 1.73–2.43) higher than in the first half-hour of work (Tucker *et al.*, 2003). Nevertheless, one investigation with Korean workers, no statistically significant associations were found for long working hours per week and accident mortality (Lee *et al.*, 2020).

Prevention of worker health and safety is necessary, since according to the International Labour Organization (ILO, 2021), 6,300 people die every day due to occupational accidents or work-related diseases – more than 2.3 million deaths per year. The human cost of this daily adversity is vast, and the economic burden of poor occupational safety and health practices is estimated at four percent of global Gross Domestic Product each year (ILO, 2021).

According to Arlinghaus *et al.* (2012), longer total break time/day was associated with a significantly longer time to injury when compared to workers without rest breaks. Indicating that when the sum of the pauses was > 30 minutes (HR 0.34, 95% CI 0.23–0.51), the risk was lower. Despite this, a review found that studies of moderate-quality evidence showed that the use of breaks had no detrimental effect on work productivity (Waongenngarm *et al.*, 2018).

The compulsory implementation of recovery rest breaks in slaughterhouses as a preventive measure for fatigue and occupational diseases progressed in terms of health and safety at work. Concomitantly, other measures have been recommended to mitigate occupational risks in this sector: reducing the work pace (Reis *et al.*, 2005a; 2005b; 2017), performing job rotations with ≤1h intervals (Dias *et al.*, 2020) and monitoring glove conditions used, replacing them when necessary to provide adequate thermal insulation of the hands (Tirloni *et al.*, 2018).

Guidelines for rest break determination and ideal conditions of the rest area in slaughterhouses

Based on the results of this study and considering requirements established in NR-36 (Brasil, 2013), guidelines for determining pauses and ideal rest area conditions in slaughterhouses were defined:

- Check the workers' preference in relation to the rest break schedules (frequency, duration, and distribution). For 60 min of pause - 6 x 10 min or 4 x 15 min or 3 x 20 min or one longer pause for snack and other smaller ones - 1 x 20 min and 1 x 10 min and 2 x 15 min or another configuration;
- Identify the relocation time to the bathroom and/or rest area and the return to the workstation, applies to moderate walking speed (0.5 m/s to 1.0 m/s) (ISO, 2003); the time to remove and put on PPE; the time to use the bathroom and the remaining time to rest. Analyze different jobs and workers to understand the reality of each work sector/table;
- If the relocation time (round trip) is more than half the rest break time, check the possibility of building rest areas closer to the sectors;
- The rest break areas should offer thermal and acoustic comfort for workers, regardless of whether the breaks are thermal or psychophysiological, with access to chairs and drinking water. Additionally, have a clock that is easily visible for workers (to control the rest break duration);
- Workplaces must have visible clocks for workers to control breaks. For thermal pauses, clocks must be available at the exit area of the artificially cold rooms;
- Monitor the workers' demand for bathrooms during rest breaks, and if necessary, adjust the number of bathrooms to accommodate the number of users;
- Instruct the workers that the physiological rest break begins when the worker stops working. However, in regions of Brazil that need the thermal rest breaks, the start of the break begins when they leave the artificially cold room;
- All breaks must take place on a regular basis and follow pre-determined schedules. Avoid the advance, as well as the extension of the end of the workday;
- Verify if there is an event that is interfering with the proper distribution of breaks throughout the day, such as the frequent machinery breakdowns. If this occurs, resolve it as soon as possible;
- Distribute rest breaks in the shift so that the periods of continuous work are as uniform as possible;
- In addition to the workers' opinion and mapping the variables that may interfere with their rest, the

purposes of the rest break must be determined. The rest break scheme must first meet the legal requirement (NR-36) (Brasil, 2013), and subsequently, the evaluation method chosen for the ergonomic risk analysis.

Hence, it is suggested that health and security managers evaluate the reality of the slaughterhouse reality, determine the objectives of rest breaks and organize them in the best way to promote physiological and/or thermal rest for workers, as recommended by NR-36.

Strengths and limitations

One of the limitations of this study was the difficulty in measuring the duration and distance of the worker's relocation. Moreover, the lack of this information in the documents provided by the company, led us to obtain this data through the workers' testimonies. Another restriction was the need for workers to suppose what the different pause schedules would look like, which may have caused memory bias. The workers' responses as to the reasons for the break preference may have been limited as this question was descriptive. Finally, whether the workers had already carried out another rest break schedule other than the current one adopted by the slaughterhouse was not investigated. Although, as a strength, this research was exploratory, performed with more than one slaughterhouse and provided guidelines for rest break determination and ideal conditions of rest areas in slaughterhouses.

CONCLUSIONS

Most poultry slaughterhouse workers preferred the rest break schedule of 3 x 20 min, mentioning that they needed time to rest and do their activities calmly (removing and putting on PPE, going to bathroom/rest area/restaurant, eating, using the cell phone, etc.), adding that the 10-min break would be too short.

Based on the perception of almost all workers, the 10-minute break would not provide rest, as they would have many activities to do during this break. Also considering that the work in the slaughterhouse is repetitive with a high work pace as many studies post-NR-36 confirmed, the preferred duration was the one with the longest rest break, which promoted the satisfaction of most workers analyzed.

Thereby, experimental studies with direct and indirect measures that verify the effects of different rest break schedules on the physiological recovery (fatigue and bodily temperature) of slaughterhouse workers must be carried out. However, controlling the variables of work pace, ambient temperature, PPE use, type of work performed, duration of relocating to the bathroom/rest area, hours of sleep, performance of job rotations, among others. These results will determine the necessary frequency and duration of breaks to achieve this objective, as well as provide subsidies to improve the working conditions in Brazilian slaughterhouses.

REFERENCES

ABPA - Brazilian Association of Animal Protein. Annual Report 2020. São Paulo: ABPA; 2020 [cited 2020 Ago 10]. Available from: http://abpa-br.org/wp-content/uploads/2020/05/abpa_relatorio_anual_2020_portugues_web.pdf

AMI - American Meat Institute. Worker safety in the meat and poultry industry. Washington, DC, USA, 2013; p. 202. [cited 2020 Set 14]. Available from: https://www.meatinstitute.org/index.php?ht=a/GetDocumentAction/i/83419/

Arlinghaus A, Lombardi DA, Courtney TK, Christiani DC, Folkard S, Perry MJ. The effect of rest breaks on time to injury — a study on work-related ladder-fall injuries in the United States. Scandinavian Journal of Work, Environment & Health 2012;38(60):560-567.

Brasil. Decreto-Lei 5.452 de 1º de maio de 1943. Consolidação das Leis do trabalho. Brasília; 1943. [cited 2020 Ago 15]. Available from: http://www.planalto.gov.br/ccivil_03/decreto-lei/del5452.htm

Brasil. Ministério da Economia. Secretaria da Previdência, 2019. Anuário estatístico de acidentes de trabalho. Brasília; 2019. [cited 2021 Mar 31]. Available from: https://www.gov.br/previdencia/pt-br/assuntos/previdencia-social/saude-e-seguranca-do-trabalhador/dados-de-acidentes-do-trabalho

Brasil. Ministério do Trabalho e Emprego. Portaria MTE n. 555, de 18 de abril de 2013. Norma Regulamentadora 36. Segurança e Saúde no Trabalho em Empresas de Abate e Processamento de Carnes e Derivados. Brasília: MTE; 2013.

Brasil. Tribunal Superior do Trabalho. Súmula nº 438. Intervalo para recuperação térmica do empregado. Ambiente artificialmente frio. Horas extras. Art. 253 da CLT. Aplicação analógica - Res. 185/2012, DEJT divulgado em 25, 26 e 27.09.2012, Brasília; 2012. [cited 2021 Abr 01]. Available from: https://www3.tst.jus.br/jurisprudencia/Sumulas_com_indice/Sumulas_Ind_401_450.html#SUM-438

Caldwell JA, Caldwell JL, Thompson LA, Lieberman HR. Fatigue and its management in the workplace. Neuroscience & Biobehavioral Reviews 2019;96:272-289.

Camargo VM. A implementação de pausas psicofisiológicas em uma indústria de processamento de frango: a perspectiva dos trabalhadores [dissertação]. Florianópolis (SC): Universidade Federal de Santa Catarina; 2015.

Chotiphan C, Auttanate N, Maruo SJ, Näyhä S, Jussila K, Rissanen S, *et al.* Prevalence of cold-related symptoms among Thai chicken meat industry workers: Association with workplace temperature and thermal insulation of clothing. Industrial Health 2020;58:460-466.

Colombini D, Occhipinti E, Fanti M. Método Ocra para análise e a prevenção do risco por movimentos repetitivos: manual para a avaliação e a gestão do risco. 2nd ed. Curitiba: Escola OcraBrasiliana; 2014.

Colombini D, Occhipinti E. Risk analysis and management of repetitive actions: a guide for applying the OCRA System (Occupational Repetitive Actions). 3rd ed. Boca Raton: CRC Press; 2017

Denadai MS, Alouche SR, Valentim DP, Padula RS. An ergonomics educational training program to prevent work-related musculoskeletal disorders to novice and experienced workers in the poultry processing industry: a quasi-experimental study. Applied Ergonomics 2021;90:103234

Dias NF, Tirloni AS, Reis DC, Moro ARP. Effect of job rotation on the risk of developing UL-WMSDS in poultry slaughterhouse workers. Brazilian Journal of Poultry Science 2019;21:1-12.

Dias NF, Tirloni AS, Reis DC, Moro ARP. Risk of slaughterhouse workers developing work-related musculoskeletal disorders in different organizational working conditions. International Journal of Industrial Ergonomics 2020;76:102929.

Dias NF, Tirloni AS, Reis DC, Moro ARP. The effect of different work-rest schedules on ergonomic risk in poultry slaughterhouse workers. Work 2021;69(1):215-23.

Fischer D, Lombardi DA, Folkard S, Willetts J, Christiani DC. Updating the "Risk Index": asystematic review and meta-analysis of occupational injuries and work schedule characteristics. Chronobiology International 2017;34(10):1423-38.

Harmse JL, Engelbrecht JC, Bekker, JL. The impact of physical and ergonomic hazards on poultry abattoir processing workers: a review. International Journal of Environmental Research and Public Health 2016;13(2):197.

Hembecker PK, Reis DC, Konrath AC, Gontijo LA, Merino EAD. Investigation of musculoskeletal symptoms in a manufacturing company in Brazil: a cross-sectional study. Brazilian Journal of Physical Therapy 2017;21(3):175-83.

IBGE - Instituto Brasileiro de Geografia e Estatística. Mapa de clima do Brasil. Rio de Janeiro; 2002. [cited 2020 Ago 13]. Available from: https://www.ibge.gov.br/geociencias/cartas-e-mapas/informacoes-ambientais/15817-clima.html?=&t=acesso-ao-produto

ILO - International Labour Organization. Business, occupational safety and health. 2021. [cited 2021 Apr 04]. Available from: https://www.ilo.org/global/topics/safety-and-health-at-work/events-training/events-meetings/WCMS_DOC_ENT_HLP_OSH_EN/lang--en/index.htm

ISO - International Organization for Standardization. Ergonomics. Manual handling. Part 1: Lifting and carrying [ISO 11228-1:2003]. Geneva; 2003.

ISO - International Organization for Standardization. Ergonomics of the thermal environment. Determination and interpretation of cold stress when using required clothing insulation (IREQ) and local cooling effects [ISO 11079]. Geneva; 2007.

ISO - International Organization for Standardization. Ergonomics. Manual handling. Part 3: Handling of low loads at high frequency [ISO 11228-3:2007]. Geneva; 2007.

Kilbom A. Repetitive work of the upper extremity: Part II - The scientific basis (knowledge base) for the guide. International Journal of Industrial Ergonomics 1994;14:59-86.

Lee H-E, Kim I, Kim H-R, Kawachi I. Association of long working hours with accidents and suicide mortality in Korea. Scandinavian Journal of Work, Environment & Health 2020;46(5):480-87.

Lombardi DA, Jin K, Courtney TK, Arlinghaus A, Folkard S, Liang Y, *et al.* The effects of rest breaks, work shift start time, and sleep on the onset of severe injury among workers in the People's Republic of China. Scandinavian Journal of Work, Environment & Health 2014;40(2):146-155.

OSHA - Occupational Safety and Health Administration. Prevention of musculoskeletal injuries in poultry processing. Washington; 2013 [cited 2020 Set 17]. Available from: https://www.osha.gov/Publications/OSHA3213.pdf

Park S, Lee W, Lee J-H. Can workplace rest breaks prevent work - related injuries related to long working hours? Occupational and Environmental Medicine 2020;62(3):179-84.

Phanprasit W, Chotiphan C, Auttanate N, Maruo SJ, Jussila K, Rissanen S, *et al.* Cold-related pain in the face, upper limbs, and lower body among Thai chicken industry workers: a cross-sectional study. International Archives of Occupational and Environmental Health 2021;94(5):799-812.

Ramos E, Reis DC, Tirloni AS, Moro ARP. Thermographic analysis of the hands of poultry slaughterhouse workers exposed to artificially cold environment. Procedia Manufacturing 2015;3:4252-4259.

Reis DC, Moro ARP, Ramos E, Reis PF. Upper limbs exposure to biomechanical overload: occupational risk assessment in a poultry slaughterhouse. In: Goonetilleke, R, Karwowski, W, editors. Advances in physical ergonomics and human factors. Orlando: Springer International Publishing; 2016. v.489. p. 275-82.

Reis DC, Ramos E, Reis PF, Hembecker, PK, Gontijo LA, Moro ARP. Assessment of risk factors of upper-limb musculoskeletal disorders in poultry slaughterhouse. Procedia Manufacturing 2015b;3:4309-14.

Reis DC, Reis, PF, Moro ARP. Assessment of risk factors of musculoskeletal disorders in poultry slaughterhouse. Proceedings of the International Symposium on Occupational Safety and Hygiene - SHO2015; Guimarães; 2015. Guimarães: Sociedade Portuguesa de Segurança e Higiene Ocupacionais; 2015a. p.294-296.

Reis DC, Tirloni AS, Moro ARP. Effects of reduced work pace on the risk of developing upper-limb musculoskeletal disorders in a poultry slaughterhouse. In: Karwowski W, Goonetilleke R, Xiong S, Goossens R, Murata A, editors. Advances in physical, social & occupational ergonomics; AHFE 2020; advances in intelligent systems and computing. Cham: Springer; 2020. v.1215. p.87-94.

Reis DC, Tirloni AS, Ramos E, Moro ARP. G3-2-assessment of risk factors of upper-limb musculoskeletal disorders in a chicken slaughterhouse. Japanese Journal of Ergonomics 2017;53:S458-S61.

Ruiz CR, Kupec E, Menegon FA, Ruiz PGN. Alguns resultados pós NR 36. In: Ikedo F, Ruiz R, org. Trabalhar e adoecer na agroindústria: da reabilitação profissional à construção da Norma Regulamentadora dos Frigoríficos (NR 36). 3rd ed. Florianópolis: Insular; 2017. p.159-184.

Sardá SE, Ruiz RC, Kirtsching G. Tutela jurídica da saúde dos empregados de frigoríficos: considerações dos serviços públicos. Acta Fisiátrica 2009;16(2):59-65.

Tirloni AS, Reis DC, Borgatto AF, Moro ARP. Association between perception of bodily discomfort and individual and work organisational factors in Brazilian slaughterhouse workers: a cross-sectional study. BMJ Open 2019a;9:e022824.

Tirloni AS, Reis DC, Dias NF, Moro ARP. Evaluation of Worker Satisfaction with the Use of Hand Tools in a Poultry Slaughterhouse, in: Goonetilleke R, Karwowski W, editors. Advances in physical ergonomics & human factors. AHFE 2018. Advances in intelligent systems and computing. Cham: Springer; 2019b. v.789. p.476-88.

Tirloni AS, Reis DC, Ramos E, Moro ARP. Thermographic evaluation of the hands of pig slaughterhouse workers exposed to cold temperatures. International Journal of Environmental Research and Public Health 2017;14:838.

Tirloni AS, Reis DC, Santos JB, Reis PF, Barbosa A, Moro ARP. Body discomfort in poultry slaughterhouse workers. Work 2012;41(Suppl 1):2420-2425.

Tirloni AS, Reis DCD, Dias NF, Moro ARP. The use of personal protective equipment: finger temperatures and thermal sensation of workers' exposure to cold environment. International Journal of Environmental Research and Public Health 2018;15:2583.

Tucker P, Folkard S, Macdonald I. Rest breaks and accident risk. Lancet 2003;361(9358):680.

Tucker P. The impact of rest breaks upon accident risk, fatigue and performance: a review. Work & Stress: An International Journal of Work, Health & Organisations 2003;17(2):123-37.

Vogt J. Calor y frío. In: Stellman JM, editor. Enciclopedia de salud y seguridaden el trabajo OIT. Madrid: RiesgosGenerales; 2001. v.2, pt.4.

Waongenngarm P, Areerak K, Janwantanakul P. The effects of breaks on low back pain, discomfort, and work productivity in office workers: A systematic review of randomized and non-randomized controlled trials. Applied Ergonomics 2018;68:230-39.

Yang L, Branscum A, Smit E, Dreher D, Howard K, Kincl L. Work-related injuries and illnesses and their association with hour of work: Analysis of the Oregon construction industry in the US using workers' compensation accepted disabling claims, 2007-2013. Journal of Occupational Health 2020;62:e12118.

Yeow PHP, Sen RN. Ergonomic improvements of the visual inspection process in a printed circuit assembly factory. International Journal of Occupational Safety and Ergonomics 2004;10(4):369-85.

Yung M, Kolus A, Wells R, Neumann WP. Examining the fatigue-quality relationship in manufacturing. Applied Ergonomics 2020;82:102919.