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Diagnosis of the impact of Covid-19 on artisanal cheese production in the semi-arid region of Brazil

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Abstract

The objective of this study was to present information on the impacts resulting from Covid-19 on the artisanal coalho cheese production chain about: access to information; socioeconomic; income and government support; healthcare. The interviews were conducted using the Google Forms tool, with milk and artisanal coalho cheese producers in Rio Grande do Norte, Brazil. The producers obtained a lot of information transmitted on television (66%); the majority to adhere to health protocols. There was instability in the production, with an initial need to reduce production resulting from prohibitive measures to trade. The level of demand with regard to the consumer market increased with the quality of milk and cheeses. An allegation of lack of support from the government to maintain the activity was also verified in 78.7% of the interviewees, but 83% had resorted to emergency aid. Therefore, it can be concluded that the challenges imposed by the pandemic are not just sanitary. The study confirmed the need to restructure public services and policies. These results can provide compelling evidence about the rural context in the country.

Keywords: coalho cheese; sanitary protocols; family income; socioeconomic; rural area.

Practical Application: Rural populations are socioeconomically and politically vulnerable in a pandemic scenario.

1 Introduction

Covid-19 (Coronavirus Disease), discovered in China in December 2019, and spread globally in 2020 becoming a pandemic. It is receiving a lot of scientific attention and radically interfering with people's lives in all spheres. Pandemic is a term that designates an epidemiological trend, indicating that many outbreaks are happening at the same time and spread far and wide. The Covid-19 pandemic changed the world scenario and brought countless economic, political, and social consequences, and above all impacted human health due to its degree of lethality and sequelae (Xavier-Santos et al., 2022). The SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2), is a highly transmissible, pathogenic and rapidly spreading virus that threatens human health and public safety, is considered highly contagious and represents the most serious threat to health in this century (Hu et al., 2021). However, outbreaks are not the same, and can establish relationships with socioeconomic, cultural, environmental, collective or even individual conditions (Fundação Oswaldo Cruz, 2021). In this conjunction of factors, research bodies needed to devise strategies, integrating multidisciplinary teams to decipher the SARS-CoV-2 virus, hitherto unknown, but causing a very serious infection which was decimating populations around the world, representing a major challenge to be faced by all (Sociedade Brasileira de Pediatria, 2020).

The new coronavirus, as it was initially called, has a high transmissibility rate, and there was no treatment or vaccine at the time, causing high lethality and mortality rates. However, despite the contagion having a global impact, the analyzes were mainly focused on urban areas, while its effects on rural areas, consequences on production, access to information and public policies were little researched. The effect of the Covid-19 pandemic on agriculture, depends on the product, the location and the economic situation of the impacted place (Laborde et al., 2020).

Residents of rural areas represent about half of the world's population, yet they have less access to care and have the worst health conditions when compared to urban populations (Targa et al., 2013). These communities are composed of millions of people - rural producers and their families – and were left vulnerable in the socio-economic, health and well-being dimensions. Six specific situations were listed with regard to farmers, farming families, agricultural employers and agricultural employees (Stephenson & Shutske, 2019): 1) impact on prices and markets, affecting milk and dairy products; 2) slowdown and shortages in supply chains, caused by logistical disruptions; 3) damage to the health of producers and their families; 4)

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eventual casualties in the workforce (absenteeism); 5) safety for workers and lack of personal protective equipment (PPE), in which there were concerns reported about the availability of protective gloves to improve milk quality and protect the health of animals and people; and 6) other interruptions related to the condition of greater isolation in which these communities are located. In this sense, recent studies on family farming point out the impact of the pandemic on: the maintenance of productive and commercial dynamics; in production volumes; in the prices received and in the decrease in the income of family farmers (Instituto Interamericano de Cooperação para a Agricultura, 2020; Salazar, 2020; Banco Interamericano de Desarrollo, 2020).

When evaluating the impacts of the pandemic on rural producers in Rio Grande do Norte, it appears that the effects on these populations had implications on milk and coalho cheese production, as well as the marketing of products. It is worth noting that very little attention was paid in the studies carried out around/during the pandemic to the agrarian sector, despite being an area of fundamental social and economic importance for the country. Thus, urban centers played a prominent role, ignoring 15.28% of people living in rural areas, with the northeast region having 26.88% of inhabitants (Instituto Brasileiro de Geografia e Estatística, 2021).

Some studies have cited that the countryside tends to have worse conditions of poverty (Weber & Miller, 2017) and employment opportunities (Green, 2017; Thiede & Slack, 2017), and policies aimed at rural health in Brazil have been shown to be fragile (Franco et al., 2021) in relation to urban areas. These inequalities can be seen in several areas: access to diagnosis and treatment, as well as adequate housing, water and sanitation, adequate food and nutrition, among others (Fundação Oswaldo Cruz, 2021).

The scarcity of studies in the agricultural sector regarding Covid-19 is due to the lack of detailed and publicly available data on rural regions, in part due to methodological difficulties arising from the distance from the rural environment (Dillman, 2016). Rural producers fit into a wide spectrum of economic profiles, with profoundly varying levels of social and economic inequalities, in which those who are deeply impoverished exist (Farrell, 2020; Ruvalcaba-Gómez et al., 2020). It is likely that this region represents the impacts of the pandemic on rurality due to its social and economic characteristics, making it suitable for a broader comparison.

Thus, newly collected data through structured questionnaires were used herein, specifically with milk producers and artisanal coalho cheese (ACC) producers in the Seridó region of Rio Grande do Norte, Brazil, evaluating the impact of the pandemic on access to information, on the production chain (production, marketing and consumer market), on income and government support. The Seridó region has expressiveness with outstanding cultural and socioeconomic importance of the ACC in the territory, and for this reason it is indicated to be the study object.

Therefore, the objective of this study is to present general information about the impacts resulting from Covid-19 for artisanal coalho cheese producers.

2 Materials and methods

2.1 Contextualization of the region and study period

The delimitation of the geographic space for the study sought to identify the region of the state of Rio Grande do Norte (RN) in Brazil where there is a long tradition in ACC production, as well as a greater concentration of manufacturing establishments.

The Seridó region of RN, located in the Central Potiguar Mesoregion, is divided into three microregions: Seridó Ocidental, Seridó Oriental and Serra de Santana, located in the middle of the semi-arid area of Northeast Brazil. Such dimensions provide that the space delimited as Mesoregion has a regional identity, whose area is 9,862,887 km^2 and its population corresponds to 291,868 inhabitants (Instituto Brasileiro de Geografia e Estatística, 2017). The geographic scope of the region comprises 25 municipalities of the 167 which compose the state: Acari, Bodó, Cerro Corá, Carnaúba dos Dantas, Caicó, Cruzeta, Currais Novos, Equador, Florânia, Ipueira, Jardim de Piranhas, Jardim do Seridó, Jucurutu, Lagoa Nova, Ouro Branco, Parelhas, São Fernando, São Vicente, São João do Sabugi, São José do Seridó, Santana do Seridó, Santana do Matos, Serra Negra do Norte, Timbaúba dos Batistas, and Tenente Laurentino Cruz.

The interviews were conducted between November 2019 and December 2020.

2.2 Selection of the milk and ACC producers

The selection of participants in this study considered the following criteria: having a registration with Sebrae RN and/or registration with cooperatives in the region, in addition to having an easier-to-access location for conducting the interviews. Participants belonged to two groups: (1) milk producers and suppliers for cheese makers; (2) ACC producers, who sold any quantity of their production. This sampling collection plan serves the purpose of the study, as the selected participants are representatives of the population of interest.

2.3 Research structure

Research planning was carried out in stages (Table 1).

Data collection instrument

Data were collected through applying a structured questionnaire considering the groups of interlocutors, milk

Table 1. Structure of the research stages.

RESEARCH STRUCTURE	
Stage 1	Identification of important issues for the study: analysis of types of research on the subject;
Stage 2	Elaboration of the data collection instrument (questionnaire);
Stage 3	Pilot project to apply questionnaires and make necessary adjustments;
Stage 4	Data collection: application of face-to-face questionnaires;
Stage 5	Data tabulation;
Stage 6	Interpretation and discussion of results

producers and ACC. A survey was used with the help of the Google Forms research management application in which a structured questionnaire is aimed at a certain standardization in the data collection process (Malhotra, 2011). Survey method research can be carried out in person, over the internet, by telephone, or through the post.

The survey research was initially planned to be face-to-face, but had to undergo adaptations due to Covid-19. Therefore, there was an attempt to carry out it through the internet due to restrictions on movement and agglomeration of people in the period, but the interviewees (milk producers and ACC) claimed a certain degree of difficulty in the questions proposed in the online questionnaire. In turn, face-to-face collection was made unfeasible for several months with the country in "lock down", which was only possible after being released from the strictest health restrictions. Thus, the collection was carried out through Google Forms® from November 2019 to December 2020, distributed in visits to properties, meetings in cooperatives and unions, free fairs and local commerce.

All preventive measures were taken during this period in relation to the new coronavirus, including the need to reduce the number of interviews, which were carried out in a longer period of time than expected. Before answering the questions, the producers received information with the description, objective, and importance of the research, identification of the researcher and the supporting bodies.

Preparation of diagnostic questionnaire

Structured questions were elaborated in socioeconomic and health relevance dimensions to study the impact of Covid-19 on milk and artisanal cheese production related to aspects of: a) Access to information about Covid-19; b) Perception of impacts on production, marketing and consumer market; c) Impacts on income and government support.

Application of questionnaire

A pilot test of the questionnaire was initially carried out in June 2019 to assess the dynamics of the questions and answers and consider the need for adjustments. To do so, a group of 21 milk and artisanal coalho cheese producers was used, which were indicated by Sebrae/RN, using the location and easy geographic access as a criterion. Milk producers were selected for being suppliers for these cheese makers. The questions were answered in an "interview" format, in which the interlocutor was transcribed by the interviewer. A need for some modifications to the definitive questionnaire was identified after analysis.

After the corrections were made, the definitive questionnaires were applied using structured interviews considering the groups of interlocutors, milk producers and ACC to start the information collection which was performed between November 2019 and December 2020; this period encompassed from the discovery to the initial spread of the virus, which is why there was a large time lag for resuming the research. The indicators of the interviews were tabulated, and then analyzed using descriptive statistics.

3 Results and discussion

Although the novel coronavirus initially infected people in urban regions, the contagion also spread to rural populations. In this study, the final sample contains milk producers (n=42) and ACC producers (n=47) living in rural areas. People who declared themselves to be male are the majority in the two groups surveyed, consisting of 34 (72.3%) belonging to the first group and 35 (83.3%) ACC producers.

The results are presented in three parts: Access to information on Covid-19; Perception of the impacts on production, marketing and consumer market; and Perception of impacts on income and government support. The tables in this session were elaborated by the authors based on the Structured questionnaire.

3.1 Access to information on Covid-19

Access to information is a very important component for prevention and control, preventing an even greater spread of the disease. The public response to epidemics is mainly influenced by three factors: the risk perception of the disease, the virus transmissibility and transmission through the media (Bootsma & Ferguson, 2007).

When asked about how they learned about the Covid-19 pandemic, television programs (TV) represented the largest percentage, followed by the internet and radio also reporting that they had access to a lot of information (Table 2).

In this regard, only one producer stated that he had little information. Fonseca et al. (2020) found similar data, in which most rural residents became aware of the health crisis through TV and radio. IBGE data (Instituto Brasileiro de Geografia e Estatística, 2021) indicate that 91.6% of Brazilian rural households have a TV, and 55.6% still use the internet.

Table 2. Structured diagnosis applied to dairy and artisanal cheese producers related to access to information about Covid-19.

Seq.	Access to information on Covid-19	n (%)
1	**How did you become aware of Covid-19?**	
	TV programs	31 (66%)
	Internet	15 (31.9%)
	Radio	1 (2.9%)
2	**Were you informed about Covid-19 prevention forms?**	
	I had a lot of information	46 (74.9%)
	I had little information	1 (2.1%)
3	**Did you use a mask during the Covid-19 pandemic?**	
	I used it frequently	43 (91.5%)
	I used it infrequently	4 (8.5%)
4	**Did you use ALCOHOL GEL or 70% ALCOHOL during the Covid-19 pandemic?**	
	I used them a lot	46 (97.9%)
	I didn't use them	1 (2.1%)
5	**Did you have Covid-19, as diagnosed by a medical exam?**	
	No	46 (97.9%)
	Yes	1 (2.1%)

Therefore, it is clear that TV programs for the most part and then the internet represent important information vehicles for the rural population, while it appears that the municipal health departments were not mentioned. It is worth mentioning that there was much contradictory news in relation to the virus, and its reflexes influenced the population's responses to the pandemic.

It is noteworthy that the spread of Covid-19 not only reached the health dimension, but also accentuated structural difficulties and inequalities that already exist in food systems (Fundação Oswaldo Cruz, 2021). This last finding represents an element that can refer to the idea of vulnerability to which this part of the population is still subjected.

According to the World Health Organization (WHO) classification, prevention measures are divided into drug and non-drug control, in which the latter is based on public prevention and control measures, including individual and community protection, isolation and quarantine (Gong et al., 2020). In addition, there were concerns about whether food could contribute to the transmission of Sars-Cov-2 (Rahimi et al., 2022). Based on this finding, several prevention actions were adopted by the federal, state and municipal governments to reduce the virus transmission, such as guidelines on hygiene measures, including washing hands with soap and water, use of 70% alcohol, wearing masks, as well as social measures such as home isolation to limit the movement of people.

Among the prevention forms of Covid-19 recommended by official health bodies and conveyed by the media, such as the use of masks and alcohol gel, more than 90% of respondents said they used both. Only 2.9% of them claimed to have tested positive for the disease, being male, by the time the interviews were concluded. However, adequate testing strategies for the population as a whole, and not just for specific cases, emerged late, with a direct implication on underreporting cases (Instituto Brasileiro de Geografia e Estatística, 2021). At the same time, rural residents often do not have satisfactory access to healthcare, facing difficulties to undergo Covid-19 tests (Souch & Cossman, 2021).

Despite much access to information in the rural context, it was not disseminated by the region's official health agencies, revealing an inefficiency in the public system to serve these communities. However, people adhered to prevention protocols even through recommendations disseminated by the media, preventing further spread of the virus.

3.2 Perception of the impacts on production, marketing and consumer market

The effects of the pandemic and its economic and social aspects on the production of milk and coalho cheese led to changes in the production landscape (Table 3).

The family represents more than 50% regarding the main labor used in milk and cheese production. These people have suffered direct economic risks including loss of income due to the need for isolation and protection needed to reduce the likelihood of infection.

Social isolation was one of the first preventive measures to be taken among the health safety and protection protocols decreed by the WHO, among which events that allowed people to gather were prohibited. There was soon after an immediate stoppage of several activities such as traditional free fairs, restaurants, hotels and events.

Table 3. Structured diagnosis applied to milk and artisanal cheese producers related to the perception of the impacts on production, marketing and consumer market.

Seq	Perception of the impacts on production, marketing and consumer market	n (%)
1	**What is the MAIN workforce used in your cheese production?**	
	Family	33 (70.2%)
	Family and hired	10 (21.3%)
	Hired	4 (8.5%)
2	**What is the MAIN workforce used in your milk production?**	
	Family	22 (52.4%)
	Family and hired	14 (33.3%)
	Hired	5 (11.9%)
3	**Did the amount of artisanal coalho cheese produced need to be increased or decreased at the beginning (March, April and May 2020) of the Covid-19 pandemic?**	
	It needed to be decreased	27 (57.4%)
	It didn't need to be increased or decreased	09 (19.1%)
	It needed to be increased	11 (23.4%)
4	**Did the amount of artisanal coalho cheese produced have to be increased or decreased from June 2020 with the effects of the pandemic?**	
	It needed to be decreased	3 (6.4%)
	It didn't need to be increased or decreased	15 (31.9%)
	It needed to be increased	29 (61.7%)
5	**Regarding the consumer market: Do you think that the Covid-19 pandemic has changed the consumption habits of the population in relation to the level of demand for the quality of artisanal cheeses?**	
	There was no change	24 (51.1%)
	Demand increased	23 (48.9%)

According to the interviews, the main forms of sale of cheeses and artisanal products are through intermediaries (18; 38.3%) and directly to the merchant (12; 25.5%), consequently, difficulties in marketing arose with the intensification of the measures to combat the virus spread. However, it is important to highlight that the Ministry of Agriculture, Livestock and Supply (*Ministério da Agricultura, Pecuária e Abastecimento - MAPA*) published Ordinance No. 116 considering the products, services and activities of the majority of the food, beverage and agricultural input production chain in the country as essential activities (Brasil, 2020a) while the state of public calamity resulting from the Covid-19 pandemic endured. Although the range of sectors covered is large, the economic situation had different impacts depending on the link in the production chain, which on a certain scale can cause severe damage to some rural producers. The measure was seen as positive, but still insufficient.

At the same time, as scientific knowledge about the disease evolved, the Ministry of Health and the National Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária - Anvisa*) defined good practice rules for reopening street markets to guarantee

the flow of small production (Brasil, 2020b). In this context, the municipalities established several norms that defined new ways of relationship between producers and consumers aiming to ensure the health of both and the maintenance of these markets.

There was a contrasting scenario regarding milk and cheese production between the first months of the pandemic and the following ones, in which production had to be reduced at the beginning of the pandemic (April to June), but later to be increased. This fact can be explained by the ban on the operation of several fairs and local markets for direct sales (Preiss, 2020). In addition, several restrictions imposed on trade, which closed food establishments, thereby affecting the distribution and access to food (Valadares et al., 2020). These data corroborate with Schneider et al. (2020), who stated that family farming and the supply of local markets suffered greater losses at the beginning of the pandemic due to prohibitive measures to trade. In fact, some evidence points to different effects of the pandemic on the different extracts of small-scale and family production, with it being verified that those producers integrated in agro-industrial chains and short supply chains had lower income losses (Food and Agriculture Organization of the United Nations, 2020). However, the poorest farmers were among those most economically affected by the effects of Covid-19, as they depend on short chains and local markets to commercialize their production (Favareto & Cavalcante, 2020). According to the Food and Agriculture Organization of the United Nations (2019), the pandemic is affecting global food systems worldwide, disrupting regional agricultural value chains and jeopardizing household food security. Thus, there is a need to strengthen organizational capacities through cooperatives, centers of productive associations and commercialization networks for family farming (Schneider et al., 2020). Therefore, this part of the production chain was the most affected by the pandemic scenario, demonstrating the vulnerable condition in which they find themselves.

There was a change in behavior with regard to the consumer market, with greater concern regarding the quality and safety of purchased food. This scenario was already taking shape in the food sector, but the pandemic, in a way, is normalizing this requirement. Therefore, a structure of fragility was observed in the segment, evidencing the need for organizational restructuring of production, distribution and consumption, stimulating the small producer and local trade chains. In this sense, it is worth mentioning the importance of adopting good hygienic-sanitary practices in cheese production and commercialization, as well as consumer awareness about health risks (Cardozo et al., 2021).

There was a change in behavior regarding the consumer market, with a higher level of demand in relation to the ACC quality. With regard to the food sector, people have increased concern about the quality and safety of purchased food, especially in relation to hygienic-sanitary aspects. These results corroborate those found by Rodrigues et al. (2021), in which respondents said they are more concerned about food safety and hygiene practices. It is worth mentioning that differences in nutritional composition are associated with raw material (raw milk), climate, animal feed and the technological manufacturing process (Andrade et al., 2022). However, Pelegrino et al. (2020) found that artisanal cheese producers do not have sufficient technical knowledge about control systems, such as traceability, which can protect consumer health from foods that pose a health risk. Thus, there is a need to improve the cheese production process related to good manufacturing practices (Messias et al., 2022).

Since the origin of the contamination by the virus occurred in a Chinese free fair where several animals were sold and slaughtered, including wild ones, the risks of zoonotic diseases involved in the relationship between humans, animals and the natural world became more evident (Gruber, 2020; Lopes, 2020). Thus, the origin of the food to be consumed became a factor of greater attention for people, demonstrating a new consumption pattern. Thus, there were new behaviors related to health concerns, where the meaning of healthy and food was better understood during the pandemic period (Uğur & Buruklar, 2022)

The research therefore revealed that the production chain remains anchored in traditional frameworks, but that the crisis caused by the pandemic has exacerbated the urgency of adapting to new production and marketing strategies.

3.3 Perception of the impacts on income and government support

The impact of the pandemic was investigated on the social and economic scenario of agro-artisanal milk and cheese production through consequences on family income, as well as on access to public policies and use of emergency aid (Table 4).

The vast majority responded that no incentives involving production were carried out regarding some form of support for the activity by the public authorities. Similar results were

Table 4. Structured diagnosis applied to milk and artisanal cheese producers related to the perception of the impacts on family income and government support.

Seq.	Perception of the impacts on income and government support	n (%)
1	**Did you receive some support from the government to maintain your activity?**	
	I didn't receive any kind of support	37 (78.7%)
	I received a little support	9 (19.1%)
	I received a lot of support	1 (2.1%)
2	**How was your family income affected during the Covid-19 pandemic?**	
	It worsened	18 (38.3%)
	There was no change	19 (40.4%)
	It improved	10 (21.3)
3	**Did you have to resort to emergency aid from the government?**	
	No	39 (83%)
	Yes	8 (17%)
4	**Were you able to receive emergency aid from the government?**	
	No	10 (21.3%)
	Yes	37 (78.7%)
5	**What gender do you identify as?**	
	Male	34 (72.3%)
	Female	13 (27.7%)

reported by Futemma et al. (2021), who reported that the federal government coordinated national policies aimed at small rural producers, but that they met the demand of small rural producers very precariously and late during the pandemic. According to Del Grossi (2020), half of family farmers in the country (51%) reported a decrease in gross monthly family income for the month of July/2020. Therefore, the inefficiency of efficient public policies aimed at supporting the small-scale producer is demonstrated.

On the other hand, emergency aid (EA) from the federal government, an assistance measure in the form of a financial benefit (Brasil, 2020c), was received by the largest share of producers. Of the 9.4 million rural households (13% of the nearly 71 million households in the country), 5.3 million had access to EA in May, an expressive reach of 56.2%, with a large amount of resources being directed to the households of lower income. It is worth noting that this coverage in rural areas was greater than in urban areas, where 36.4% of the 61.4 million households, or 22.3 million, received the benefit (Centros de Estudos Avançados de Economia Aplicada, 2020). However, only 21.3% stated that income had improved. This situation of inequality reverberated the lack of policies to support the activity, as well as the need for emergency aid.

One of the bottlenecks for artisanal milk and cheese producers is the production flow, as these products need adequate storage conditions because they are perishable, and they need to be sold quickly, either due to the characteristics of the production process or financial need. According to the data collected, 100% of artisanal coalho cheese production is sold within seven days of production. Thus, the fact that many municipalities established quarantine and decreed restrictions on hours or the closing of trade and suspended street markets interfered with the marketing of products, in turn decreasing family income. Agriculture has been impacted by the pandemic both in terms of supply and demand for food, and it is important for municipal and local governments to act in preventing the spread of the virus (Food and Agriculture Organization of the United Nations, 2020).

Therefore, fluctuations in demand in the milk and cheese production system caused by the infection prevention and control measures made it difficult to sell the products, impacting the income of families, which did not have government support to maintain the activity.

4 Conclusions

The challenges posed by Covid-19 are not just sanitary. The impact of the pandemic was far-reaching in the primary, secondary and tertiary sectors, a tripod of paramount socioeconomic importance.

The study confirmed the vulnerability of these populations and the need to restructure public services and policies, taking into account the rural plurality in relation to the urban area. These mechanisms must form a foundation for better production, supply and consumption conditions, thereby strengthening the autonomy of families and providing better living conditions, which are of great importance for rural development.

These results can provide compelling evidence about the rural context in the country, especially those with similar socioeconomic conditions. However, the impacts of the Covid-19 pandemic remain incomplete, requiring more indicators for rural areas.

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