
Trends in Safety in Fruits and By-products in Compliance with Good Manufacturing Practices

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Abstract: The present scientific research work was to demonstrate that with the increase in the degree of compliance with Good Manufacturing Practices in five wineries, the confidence of consumers of alcoholic beverages was achieved, in addition to increasing the volume of sales, which means that the higher the percentage of application of the GMP, the greater the volume of sales, for which the sanitary control and monitoring of these warehouses was carried out for three years (2017-2019) in terms of the application of Good Manufacturing Practices (GMP) in the production process production of alcoholic beverages, evidencing that each year the percentage of compliance with GMP increased and it was possible to demonstrate through laboratory analysis that the fermented beverages produced in the five wineries did not represent any risk to the health of consumers, since that met the physical and chemical requirements, in addition to not containing heavy metal residues, which is why which, it can be guaranteed that they are innocuous products and suitable for human consumption. The results of the surveys carried out on producers and consumers of alcoholic beverages are also shown, where it can be seen that when there is a higher percentage of compliance with GMP, the confidence of final consumers increases.

Keywords: Food Safety, Good Manufacturing Practice, Grapes and Derivatives, Production, Degree of Compliance

1. Introduction

The global marketing of food is one of the activities that has been boosted on a large scale in recent times with the intensive use of technology and the media. It is in this context that the actors who in some way define the control systems that must be applied to the products to be manufactured and in some way be able to guarantee the "safety" of the food product, in order to satisfy the ever-increasing demands of consumers in turn more informed [1, 20].

1.1. Safety

Innocuousness is defined by the Royal Academy of the Spanish Language as "the character of being innocuous," and innocuous is defined as "that does not cause harm." With the exception of some specific food products that contain components that can cause an allergic reaction in sensitive people, food alone does not cause harm. Health damage may be caused by agents that may be present in the product. These agents can be biological, physical and chemical; that when ingested by the consuming population can give rise to the so-

called ETAS (Foodborne Diseases) [6].

Therefore, "Safety" is defined as the condition of food that guarantees that it will not cause harm to the consumer when it is produced, prepared and/or consumed according to the use to which it is to be put [18].

1.2. Good Manufacturing Practices

According to SENASAG [15], GMPs are general principles of handling, control, design, process, hygiene and sanitation that aim to create favorable conditions for the production of safe food.

They are made up of 10 aspects: Infrastructure, Raw Materials and Supplies, Processes, Personnel, Finished Product, Equipment, Services, Waste Management, Pest Control, and Transportation.

It is important to mention that the results of the theoretical trends of safety in grapes and derivatives according to the requirements established by SENASAG (National Service of Agricultural Health and Food Safety-Bolivia) in Administrative Resolution 143/2017, indicates that the As fruits are considered medium and low risk

products according to their degree of decomposition and their useful life, the percentage of compliance with Good Manufacturing Practices to obtain the SENASAG Sanitary Registry is 60% [16].

Reason for which the producers of grapes and derivatives in the management between the years 2010-2015, according to the data provided by the Food Safety area of the Tarija Departmental SENASAG, presented percentages of compliance with the Good Manufacturing Practices that barely exceeded the established minimum [15].

But as of the 2016 administration, the wineries began to improve compliance with Good Manufacturing Practices and guarantee the safety of the food products they were manufacturing, due to the demands of consumers and local, departmental and national markets [2].

It is for this reason that producers of grapes and derivatives, wanting to reach national markets, began to guarantee food safety through minimum compliance with Good Manufacturing Practices above 80% [17].

2. Material and Methods

During the development of this research work, the explanatory descriptive method has been used, with the purpose of: first, making a diagnosis of the situation in which the producing wineries have been working in terms of compliance with BPM. Subsequently, field work was carried out with grape and derivatives producers to identify the degree of compliance with BPM in terms of safety requirements. The information search was carried out for works published in the period 2000-2018.

For the collection of information, surveys have been carried out on one hundred producers of grapes and derivatives. The semi-structured interview technique has also been used, which consisted of using a guide with previously established topics in order to formulate the questions and guide the interview [14]. Based on this technique, primary information on grape and derivatives producers has been obtained.

In order to evaluate the results that are required to guarantee food safety in grapes and derivatives, a certain period of time of approximately one year was available, which was developed during the 2019 management and part of 2020, in order to obtain the results and consistent conclusions.

With the evaluation, it was sought to measure and analyze the effects produced by the implementation of the measures, and to be able to establish the level of compliance with the

goals and objectives outlined, and with what degree of efficacy, effectiveness and efficiency were achieved in terms of compliance with the 80% compliance with Good Manufacturing Practices to guarantee the safety of the products produced.

Through this activity, it was possible to specify the distance between the expected results and those obtained, through different instances of measurement of food safety as an independent variable, and the percentage of compliance with Good Manufacturing Practices, as the dependent variable.

Below are some groups of indicators that were used in the preliminary phase of identifying the health problem and the implementation of the policy implemented in terms of food safety at the five wineries based on the degree of compliance with Good Manufacturing Practices.:

Management indicators: for example, degree of compliance with health inspections; Degree of compliance with sampling for laboratory analysis; Degree of compliance with audits regarding compliance with Good Manufacturing Practices, Degree of compliance with audits by assigned official; Degree of response to laboratory reports regarding the degree of chemical contaminants and heavy metal residues in grapes and derivatives, among the main ones.

So the expected results (goals) were compared with the results obtained from the use of the indicators. In this way, it can be asserted that the plan was well conceived and the established activities were correctly implemented, since the indicators obtained were 95% closer to those expected.

Finally, the statistical information corresponding to the time period of the defined study (2019-2020), showed progress in relation to the proposed goals, with a clear trend, such as a reduction in cases/contamination, in the economic losses due to these causes, as well as improvements in terms of quality and safety in the production of alcoholic beverages [21].

3. Results

To verify compliance with the Good Manufacturing Practices, a sanitary control was carried out with the help of the technical and sanitary personnel of the food safety area of SENASAG Departamental Tarija, during the 2019-2020 management to five wineries that produce wines and alcoholic beverages derived from the grapes, in accordance with the requirements established for sanitary control and supervision in Administrative Resolution No. 147/2017 of SENASAG.

Table 1. Type of selected wineries.

Nº	Winery name	Company type	Location
1	Cepas del Valle	Semi industrial	Morros Blancos neighborhood, Tarija Bolivia
2	El Potro	Handmade	LAB San Gerónimo neighborhood, Tarija Bolivia
3	Bodegas La Cabaña S.R.L.	Industrial	San Jorge I Industrial Zone, Tarija Bolivia
4	Bodegas Magnus	Industrial	Torrecillas Zone, Tarija Bolivia
5	Bodegas Parascocha:	Handmade	Crossing to the Valley Community of San Isidro, Tarija Bolivia

Source: Own elaboration, 2020.

As can be seen in Table 1, the three types of food and beverage processing companies were chosen according to the categorization by type of company established by SENASAG [15]; 2 artisanal wineries, 1 semi-industrial and 2 artisanal; this in order that the selection of the sample made be as representative as possible and that the three types of grape and derivative processing companies are involved.

Below are the results obtained during the technical inspections carried out by SENASAG [15] officials in company with the researchers in terms of the percentage of compliance with Good Manufacturing Practices through the completion of the UNIA-INSPCTRL-003B inspection report, for a period of approximately 1 year (2019):

Table 2. Percentage of compliance with Good Manufacturing Practices.

Nº	Winery name	Inspection Date	Percentage of GMP.
1	Cepas del Valle:	05-15-2019	89,20 %
2	El Potro	04-04-2019	92,13 %
3	Bodegas La Cabaña S.R.L.	04-10-2019	96,36 %
4	Bodegas Magnus	12-13-2019	93,30 %
5	Bodegas Parascocha:	01-07-2019	90,27 %

Source: Own elaboration, 2020.

The percentage of the 59 aspects that they contemplate in terms of compliance with Good Manufacturing Practices according to the SENASAG [15], inspection report is very high, reaching an average value of 92.25%, which allows them to reach national marketing markets for their products wine products and also to be able to reach international markets.

Table 3. Analysis number issued by the Tarija Wine Center laboratory: CEVITA [4].

Nº	Winery name	Analysis date	Analysis number	Maximum limits allowed
1	Cepas del Valle	05-29-2019	315, 316 y 317	Within standard
2	El Potro	04-16-2019	166 y 167	Within standard
3	Bodegas La Cabaña S.R.L.	04-14-2019	174 y 175	Within standard
4	Bodegas Magnus	12-26-2019	795 y 796	Within standard
5	Bodegas Parascocha	01-04-2019	29 y 36	Within standard

Source: Own elaboration, 2020.

It is important to be able to emphasize that all the parameters analyzed are within the limits established by the NB 322002:2015 [9], standard for wines, this standard establishes the maximum parameters for contaminant residues in wines that do not represent a risk to the consumer, that is, the MRL (Maximum Limit of Permitted Residues), for which it can be asserted that the wine samples analyzed do not represent any risk to public health and their safety is guaranteed.

It can also be corroborated with laboratory analyzes that compliance with Good Manufacturing Practices guarantees the production of alcoholic beverages with food safety, and therefore, that they will not cause harm to the health of consumers according to the reports laboratory issued.

The numbers of laboratory reports of laboratory analyzes issued by CEVITA (Centro Vitícola de Tarija) [4], are illustrated, which should be mentioned as a laboratory accredited by SENASAG, since it belongs to the Network of Official Laboratories for Food and Traces (RELOAA). The parameters analyzed were free and volatile acidity, free and total SO₂, reducing sugars, Cu, relative density, free dry extract, alcoholic strength, iron, ferrocyanide ion, methanol and pH, the same as found in the annexes section. It should be noted that the products analyzed are within the established parameters, especially the free and volatile acidity, whose maximum permitted limits are: 9.75 and 1 milligrams per liter, respectively, which indicates that the products are not acidic and acidity will not occur acetic fermentation, that is to say that the products can be degraded to vinegar. Another important parameter that affects safety is free and total SO₂, whose maximum allowed parameters are 75 and 300 milligrams per liter, respectively. This value is important to determine the amount of sulfur present in the wine and that can cause too much of some allergenic reactions to customers. Copper carryover is also important, as it can cause cancer problems in the consumer if it exceeds the maximum allowable limit of 1 milligram per liter.

Finally, to confirm that with the faithful compliance and application of the Good Manufacturing Practices, safe food and beverages are always produced and suitable for human consumption, a sample of the wines produced by said wineries was taken and taken to the CEANID laboratory (Center for analysis, research and development) of the Autonomous University "Juan Misael Saracho" [3], 5 samples to analyze pesticide residues and heavy metals (chemical contaminants), whose results are cited below:

Table 4. Number of analyzes of chemical pollutants emitted by the laboratory Research and Development Analysis Center: CEANID [3].

Nº	Winery name	Analysis date	Analysis number	Maximum limits allowed
1	Cepas del Valle	12-16-2019	1428FQ832	Within standard
2	El Potro	12-16-2019	1429FQ833	Within standard
3	Bodegas La Cabaña S.R.L.	12-16-2019	1430FQ834	Within standard
4	Bodegas Magnus	12-16-2019	1431FQ835	Within standard
5	Bodegas Parascocha	12-16-2019	1432FQ836	Within standard

Source: Own elaboration, 2020.

Table 4 shows the analysis of 20 pesticides and 6 heavy metals in wine samples from the 5 selected wineries.

According to the reports issued by the CEANID laboratory, it was possible to determine that there are no residues of chemical contaminants in the 5 wines analyzed, in terms of the residues of the 20 pesticides analyzed and the 6 heavy metals (Cd, Cu, Cr, Mn, Pb and Zn) that may represent health risks, only traces of the pesticide chlorpyrifos were found, which is within the permitted MRLs, therefore, food safety can be guaranteed based on a percentage greater than or equal to 90% compliance in Regarding the 59 aspects included in the Act of Good Manufacturing Practices established by SENASAG [15], and it was possible to guarantee the production of healthy food

and beverages that protect the health of consumers throughout the national territory.

To carry out the characterization of the Good Manufacturing Practices, the percentage of compliance was collected in the years 2017, 2018 and 2019, according to the official data of technical reports of follow-up to the 5 selected wineries in terms of the percentage of compliance with Good Manufacturing Practices, which was provided by the Food Safety area of SENASAG [16], for which the results obtained that were provided by the marketing area of the five selected wineries were analyzed, in terms of the number of bottles of fermented beverages sold in these warehouses, whose data is illustrated in table 5:

Table 5. Percentage of compliance with BPM and sales in the last 3 years (2017-2019).

Winery name	Year	Percentage GMP	Ventas en botellas
Cepas del valle	2017	70	120000
	2018	80	150000
	2019	89	200000
El Potro	2017	75	15000
	2018	85	150000
	2019	92	200000
La Cabaña	2017	80	3000000
	2018	85	3150000
	2019	96	4000000
Bodegas Magnus	2017	75	40000
	2018	80	45000
	2019	93	100000
Parascocha	2017	65	3000
	2018	78	4000
	2019	90	8000

Source: Own elaboration based on data from SENASAG and wineries, 2020.

Table 5 shows the increase in the number of bottles sold due to the increase in compliance with BPM's, due to consumer confidence [17].

For a better understanding, the graphic interpretation of the results obtained according to the degree of compliance with

Good Manufacturing Practices based on the sale of bottles of fermented beverages (wines) in the years 2017, 2018 and 2019 of the companies is shown below five wineries under the research study: Cepas del Valle, El Potro, La Cabaña, Bodegas Magnus and Parascocha, respectively:

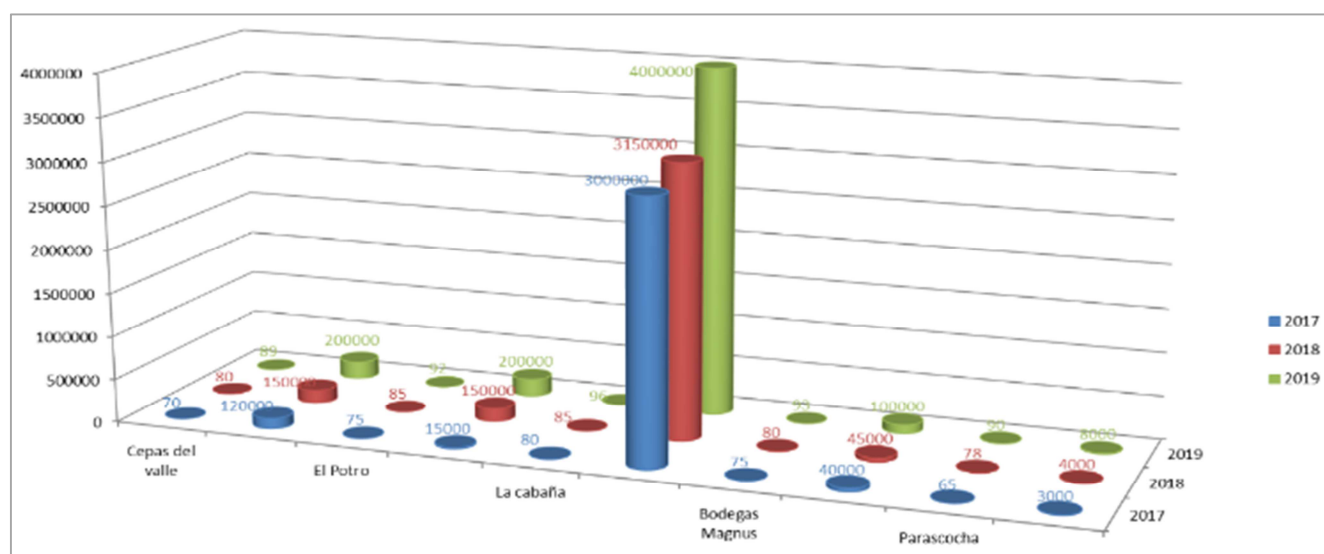


Figure 1. Graphic interpretation of the results obtained.

As can be seen in figure 1, it was found that there was a considerable increase in the sale of alcoholic beverages when the percentage of compliance with Good Manufacturing Practices gradually increased, therefore, the wineries in question managed to increase their income. by an average of 30% according to the increase in the percentage of compliance with BPM's, which shows that if Good Manufacturing Practices are fully complied with and in a high percentage, the wineries will be able to gain the trust of consumers and improve their economic returns and guarantee the food safety of food and beverages intended for human consumption.

Characterization of the opinion of grape producers in relation to good manufacturing practices and the opinion of consumers on food safety.

According to the opinion issued by the owners and operators of the five wineries that were taken into account in this research work, which reached more than 80 people interviewed, between primary producers in the vineyards and the operators of the wineries, In addition to more than 100 suppliers of raw material (grapes), they indicate that if higher percentages (90%) of compliance with Good Manufacturing Practices had not been achieved, sales of fermented beverages could not have been increased, since they did not consumers would have had the confidence and losses due to returns of processed products would not have been reduced, therefore, if compliance with GMPs is not guaranteed, alcoholic beverages could not be produced with food safety [16].

In addition, 100 consumers of food products were interviewed in order to ask them if it is important to comply with Good Manufacturing Practices to guarantee food safety throughout the chain, that is, from primary production to final consumption [17].

Reason why it can be proven that to guarantee the preparation of safe food and beverages intended for human consumption, Good Manufacturing Practices must be fully complied with and in a high percentage.

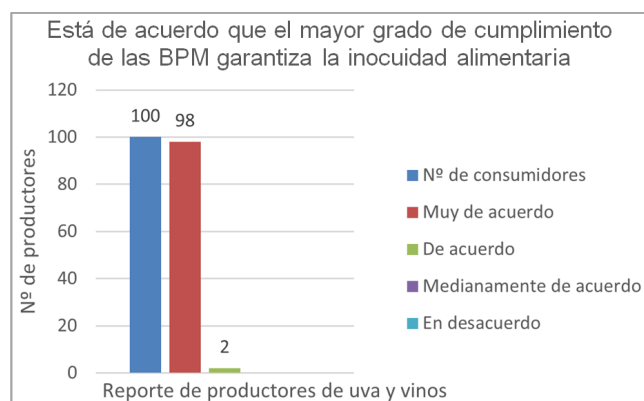


Figure 2. Report of grape and wine producers.

Regarding consumers, it was established that the 100 people interviewed stated that they have confidence in the processed products and that food safety is essential

throughout the chain to guarantee food safety through compliance with Good Manufacturing Practices and food safety standards. Hygiene, respectively [10].

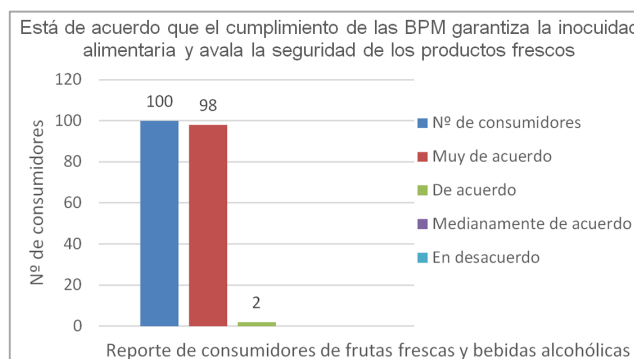


Figure 3. Fresh fruit consumer report.

In the figure you can see the report to consumers of fresh fruits.

4. Discussion

The lack of food safety is a progressive public health problem exacerbated by the globalization of markets and the complexity of control throughout the industrial, semi-industrial and artisanal food chain. Reason why, developing effective ways for the evaluation and diagnosis of food safety must be essential to attack and solve this problem [12, 19].

There are very few reviews on food safety in Latin America, characterized especially by their focus on outbreaks of specific microorganisms and pathogens due to the lack of application of Good Manufacturing Practices [5].

As an example, a study on surveillance of FBD outbreaks in Chile attributed 34.1% of cases to poor food handling and 11.3% to deficiencies in the production process that involve some of the GMP aspects [11, 22].

In a subsequent review carried out in Colombia, it was possible to evaluate FBD outbreaks due to *Salmonella* spp., *Staphylococcus aureus* and *Listeria monocytogenes* associated with the consumption of chicken, observing a strong association between the consumption of grilled chicken in restaurants and disease outbreaks due to salmonellosis, due to the lack of hygiene and correct handling of food [13].

Another investigation in the same country focused on outbreaks of FBD due to *Listeria monocytogenes* in broccoli and cauliflower, evidencing the lack of information and how complicated it is to measure this problem at the national level [7].

This type of research is a starting point for the development of public policy proposals for food safety, which currently in Bolivia are not available or applied.

In this context, it is worth highlighting an investigation carried out in Mexico, which highlights the need to have a baseline and clear indicators to effectively evaluate problems

related to food safety [8].

Finally, it can be asserted that since compliance with Good Manufacturing Practices is mandatory during the production processes of food and beverages intended for human consumption to guarantee food safety, the sanitary control agencies must certify their faithful compliance with in order to protect the health of consumers.

5. Conclusions

The requirements in terms of food safety in the production of grapes and derivatives is very important and fundamental, in order to reach new market niches and improve their productivity and profitability, since with sanitary self-control systems such as Good Practices of Manufacturing ensures the safety of food and beverages intended for human consumption.

Regarding the trends for the self-control health certification of the grape and its derivatives; currently there are regulations and specialized institutions for the case, such as SENASAG.

The realization of this research work has allowed, in a great way, to sensitize the producers of grapes and derivatives to the application and compliance with national and international regulations to guarantee safety through compliance with Good Manufacturing Practices.

Finally, the limitation that was had in the present investigation was that due to lack of budget, it was not possible to carry out a greater number of laboratory analyzes of all the existing warehouses in the central valley of Tarija, in order to guarantee food safety, which is why which is urged to carry out future research on the subject in order to have food and beverages intended for human consumption that are 100 percent safe.

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