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Factors Associated with Female Participation in Extensive Livestock Farming in Spain: An Approach to Sustainability and Equity in the Agrarian Sector

Menor-de-Gaspar-Lopez, R. [1]; Carrasco-Monteagudo, I. [1]

[1] *Universidad de Castilla - La Mancha, Facultad de Ciencias Económicas y Empresariales, Albacete, España*

Abstract

Women's equitable participation in the agricultural sector transcends its social dimension and is a determining factor in generating economic benefits, including increased productivity, the promotion of sustainable development, diversification of activities, and a greater propensity for innovation and resilience. This research analyzes women participation in livestock farming in Spain, with a special focus on extensive livestock farming, with the aim of identifying the associated characteristics and providing evidence to support policies aimed at their incorporation into a declining subsector with high ecosystem value. The research questions focus on determining the level of female participation in livestock farming, as well as the factors that influence such participation. The study is based on two main sources: the 2020 Agricultural Census and the Extensive Livestock Farming Map. The results show that extensive livestock farming offers favorable conditions for equity and proven environmental and territorial benefits, reinforcing its potential as a tool for sustainable rural development. Logistic regression models identify older age, farm size, membership of family businesses, and production orientation as significant factors, with a preference for large livestock in general livestock farming and small livestock in extensive farming. These findings confirm the suitability of extensive livestock farming for promoting equality and outline strategic lines for the formulation of public policies. Female participation is emerging as a key element for the resilience of the sector, while their late incorporation and lesser experience underscore the need to eliminate barriers such as age in the granting of aid and to ensure specialized training programs.

Keywords: extensive livestock farming, women, gender equality, livestock farming, agriculture

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Marta Chiappe
Universidad de la República, Facultad de Agronomía, Montevideo, Uruguay

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Correspondence

Rodrigo Menor-de-Gaspar-Lopez
rodrigo.menorgaspar@alu.uclm.es

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Factores asociados a la participación femenina en la ganadería extensiva: Un enfoque para la sostenibilidad y la equidad en el sector agrario

Resumen

La participación equitativa de las mujeres en el sector agrario trasciende su dimensión social y se configura como un factor determinante para la generación de beneficios económicos, entre los que destacan el incremento de la productividad, la promoción del desarrollo sostenible, la diversificación de actividades y una mayor propensión a la innovación y la resiliencia. La presente investigación analiza la participación femenina en la ganadería en España, con especial atención a la ganadería extensiva, con el propósito de identificar las características asociadas y aportar evidencia que sustente políticas orientadas a su incorporación en un subsector en retroceso y con elevado valor ecosistémico. Las preguntas de investigación se centran en determinar el nivel de participación femenina en la ganadería, así como los factores que inciden en dicha participación. El estudio se apoya en dos fuentes principales: el Censo Agrario 2020 y el Mapa de Ganaderías Extensivas. Los resultados evidencian que la ganadería extensiva presenta condiciones favorables para la equidad, lo que refuerza su potencial dentro del desarrollo rural sostenible. Los modelos de regresión logística identifican como factores significativos la mayor edad, el tamaño de la explotación, la pertenencia a empresas familiares y la orientación productiva, con preferencia por ganado mayor en la ganadería general y por ganado menor en la extensiva. Estos hallazgos confirman la idoneidad de la ganadería extensiva para promover la igualdad y delinean líneas estratégicas para la formulación de políticas públicas. La participación femenina se perfila como un elemento clave para la resiliencia del sector, mientras que su incorporación tardía y con menor experiencia subraya la necesidad de eliminar barreras como la edad en la concesión de ayudas y garantizar programas de capacitación especializada.

Palabras clave: ganadería extensiva, mujer, igualdad de género, ganadería, agricultura

Fatores associados à participação feminina na pecuária extensiva: Uma abordagem para a sustentabilidade e a equidade no setor agrícola

Resumo

A participação equitativa das mulheres no setor agrícola transcende a sua dimensão social e configura-se como um fator determinante para a geração de benefícios económicos, entre os quais se destacam o aumento da produtividade, a promoção do desenvolvimento sustentável, a diversificação das atividades e uma maior propensão para a inovação e resiliência. A presente investigação analisa a participação feminina na pecuária na Espanha, com especial atenção à pecuária extensiva, com o objetivo de identificar as características associadas e fornecer evidências que sustentem políticas orientadas para a sua incorporação num subsetor em declínio e com elevado valor ecossistémico. As questões de investigação centram-se em determinar o nível de participação feminina na pecuária, bem como os fatores que influenciam essa participação. O estudo baseia-se em duas fontes principais: o Censo Agrícola 2020 e o Mapa de Pecuária Extensiva. Os resultados evidenciam que a pecuária extensiva apresenta condições favoráveis à equidade, o que reforça o seu potencial no âmbito do desenvolvimento rural sustentável. Os modelos de regressão logística identificam como fatores significativos a idade mais avançada, o tamanho da exploração, a pertença a empresas familiares e a orientação produtiva, com preferência por gado de grande porte na pecuária em geral e por gado de pequeno porte na pecuária extensiva. Essas descobertas confirmam a adequação da pecuária extensiva para promover a igualdade e traçam linhas estratégicas para a formulação de políticas públicas. A participação feminina surge como um elemento-chave para a resiliência do setor, enquanto a sua incorporação tardia e com menor experiência ressalta a necessidade de eliminar barreiras como a idade na concessão de auxílios e garantir programas de capacitação especializada.

Palavras-chave: pecuária extensiva, mulher, igualdade de género, pecuária, agricultura

1. Introduction

The active and equal participation of women in the economy has been established as a desirable social objective by the Sustainable Development Goals (SDGs). However, this is not solely an ethical issue. Its significance is rooted deeply in the evident economic advantages it confers, encompassing enhanced productivity and the augmentation of global productive capacity (Morais Maceira, 2017), being especially significant the female entrepreneurship (Buendía-Martínez & Carrasco, 2013; Mari & Pogessi, 2024; Mari et al., 2024).

Targets of SDG 5 in the agricultural sector include the full and effective participation of women, equal opportunities for leadership, and the implementation of reforms that grant women equal rights to economic resources and access to land ownership and control. Women participation in agricultural entrepreneurship is defined by their decision-making regarding production, access to and control of resources and income, access to opportunities, and control over their own time (Galiè et al., 2019). The integration of women in this type of entrepreneurship is imperative for sustainable agricultural development (Balezentis et al., 2021; Bock, 2004; Heather et al., 2005; Litre et al., 2021), increased diversification of agricultural activities (De Rosa et al., 2021), and a heightened propensity for innovation and economic resilience (Balezentis et al., 2021).

Despite these acknowledged advantages, the European agricultural sector is characterized by structural incongruity and pronounced masculinity (Adinolfi et al., 2020). Statistical evidence indicates that women constitute only 28.7% of farm managers in the European Union (Cook, 2020) and 28.6% in Spain (Instituto Nacional de Estadística, 2022). Regulatory elements, such as Spain's Shared Ownership Law, and specific tax benefits for women can be the reasons for higher participation than in South America: 27% in Uruguay (Ministerio de Ganadería, Agricultura y Pesca & Instituto Nacional de Estadística, 2026); 20% in Argentina (Instituto Nacional de Estadística y Censos, 2022), and 19% in Brazil (Instituto Brasileiro de Geografia e Estatística, 2023). As stated by authors such as Lázaro et al. (2004) and Choi (2000), factors such as age, education, income disparity, and time spent at home influence women participation in the labor market. However, characteristics inherent to specific professional domains, such as the capacity to harmonize family life and professional obligations (Polachek, 1981) or the presence of prior work experience (Choi, 2000), have been shown to also exert influence on women's labor market participation. The initial hypothesis posits that the phenomenon of masculinization may exhibit notable variations across the spectrum of agricultural subsectors. This observation suggests the presence of implicit causes and distinct conditioning factors that are specific to each branch and management style. These factors, which are not overtly apparent, influence the level of female participation.

The present circumstances in the agricultural sector in Spain, characterized by the necessity of resilience, environmental sustainability, and innovation, render the integration of women particularly opportune. Traditionally, women have played a central role in extensive livestock farming[1] (Buendía-Martínez & Carrasco, 2013; Courdin, 2021; Litre et al., 2021; Menor-de-Gaspar López, Carrasco-Monteagudo & Gómez-Borja, 2025), as this type of farming depends on the family unit. Although pastoralism has mainly fallen to men, the family's dependence has promoted a high level of women participation in tasks such as caring for very young offspring, pregnant or sick animals, and often covering for men's absence in grazing work. Therefore, extensive livestock farming, with its proven positive effects on the environment, resilience, and territorial development (Barron et al., 2021; Celaya et al., 2022; Deléglise et al., 2019; Dwyer, 2022; Lasanta et al., 2022; Salachna et al., 2022), could be favored by this inclusion. This could help achieve other SDGs, such as Zero Hunger (2), Decent Work and Economic

[1] Extensive livestock farming differs from intensive livestock farming due to the following factors: grazing-base nutrition and slight use of food supplements, low production and low income, breeds adapted to the land and climate, non-permanent stabling, free mobility in rangelands, and production of ecosystem services such as habitat care, carbon sequestration, and biodiversity conservation (Herrera et al., 2018).

Growth (8), and Climate Action (13) (see Table 1). However, extensive livestock farming is experiencing a disconcerting trend of decline and abandonment in Europe (Pardini & Nori, 2011; Pinto et al., 2023; Ríos-Núñez & Coq-Huelva, 2015; Sa Rego et al., 2022) and South America (Febrer et al., 2021; Menor-de-Gaspar López, Carrasco-Monteagudo, Gómez-Borja, et al., 2025; Nin-Pratt et al., 2019).

Table 1. Sustainable Development Goals related with women participation and extensive livestock farming

SDG	Targets
5. Gender equality	**5.5** Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life. **5.A** Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance, and natural resources, in accordance with national laws.
2. Zero hunger	**2.3** By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists, and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets, and opportunities for value addition and non-farm employment. **2.4** By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters and that progressively improve land and soil quality.
8. Decent work and economic growth	**8.3** Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity, and innovation, and encourage the formalization and growth of micro-, small-, and medium-sized enterprises, including through access to financial services.
10. Climate action	**13.1** Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

This study focuses on women participation in livestock farming in general and, more specifically, in extensive livestock farming. The objective is to identify characteristics associated with women farm managers in this sector. Previous studies have identified factors that influence women participation in this sector. Courdin (2021) empirically demonstrates a relationship between symbolic power within the family, socioeconomic background, farm size, availability of labor support, and formal ownership of land and livestock. Litre et al. (2021) point out differences in livestock farms managed by women, such as farm size, greater association, diversification of activities, and sustainable practices. Buendía-Martínez & Carrasco (2013) establish that it is based on women empowerment and the general level of entrepreneurship. Some of these factors can be objectively observed in official statistics. However, the lack of data on the other factors mentioned by the authors forces us to focus on the factors that are usually collected by official means, such as age, family business, farm size, type of livestock managed, experience, training, and attendance at continuing education courses. Table 2 offers a proposed relationship between factors provided by the literature and observable factors.

The research questions that guide the study are the following: i) How do women participate in livestock farming, and more specifically, in extensive livestock farming, in Spain? ii) What factors are associated with this participation?

The subsequent sections of the article are structured as follows: firstly, the methodology used is presented; second, the results obtained; third, the discussion of the findings, and finally, the conclusions of the study.

Table 2. Relation between available data and suggested factors for women participation

Factors in literature	Available data	Reason
Symbolic power within the family	Age. Family business	Age is a fundamental element of power within the family hierarchy. The family business is centered around the family, and the symbolic power of the owner is greater within it.
Socioeconomic background	Education and training	Although education is accessible in Spain, even in rural areas, the level of education still implies significant differences among social classes.
Farm size	Farm size	Factor directly measured.
Labor support	Experience Family business	Experience guarantees the capacity to handle the workload. The family business implies the existence of family labor support.
Ownership	Not included	The study focuses on the legal owners of the farms.
Association	Attendance at continuing education courses	These types of courses are organized or advertised by associations and foster a participatory spirit.
Diversification of activities	Farm size	A small farm is necessarily linked to carrying out other activities to obtain additional income.
Sustainable practices	Type of livestock managed	The type of livestock is typically associated with either a more pastoral (sheep and goat) or more intensive (cattle) farming model.
Women empowerment	Experience. Education and training	Extensive experience can be linked to greater empowerment, as independence is a proven fact. The level of education also implies a greater capacity for analysis and action, leading to greater empowerment.
Entrepreneurship	Attendance at continuing education courses	Attendance and continuous professional development constitute, in effect, an act of entrepreneurship aimed at improving performance.

2. Materials and Methods

Since there is no official data specific to extensive livestock farming, we combined two sources: the 2020 Agricultural Census for general livestock farming and our own surveys of farmers from the ELFM (Extensive Livestock Farming Map) for extensive livestock farming. To compare these groups, we transformed the census statistics into representative provincial profiles, incorporating all available data related to the analyzed factors: sex, age, family structure, farm size, experience, education level, continuing education, and managed livestock. We created profiles of “typical male farmers” and “typical female farmers” for each of the 50 Spanish provinces. Thanks to this model, we can observe and compare the observable traits that characterize men and women in both types of livestock farming.

2.1 Validation of Initial Hypothesis

The initial hypothesis posited that there are significant differences in the participation of men and women in different sectors of agriculture (Choi, 2000; Polachek, 1981). A preliminary approach was undertaken to study the participation of men and women in various agricultural sectors.

The National Institute of Statistics (INE, in Spanish) periodically conducts an Agricultural Census to collect pertinent information regarding the state of the primary sector in Spain. This study is conducted at 10-year intervals, with the most recent iteration having been completed in 2020. It offers insights into the participation of women in various agricultural sectors, categorized based on zootechnical and agricultural criteria, including the technical-economic orientation of the farm (OTE, in Spanish).

This research aims to analyze women participation in general and in extensive livestock farming in particular, and to identify the associated factors. To ensure consistency in comparisons among populations, the study focuses exclusively on species associated with extensive systems: large livestock (cattle) and small livestock (sheep and goats).

2.2 General Livestock Farming

The 2020 Agricultural Census yielded a range of data on the characteristics of the owners. These characteristics include age, sex, and the relationship with the owner by technical-economic orientation and by total livestock units (UGT, in Spanish). According to the objective of the present study, the farms oriented towards large livestock (cattle) are defined in the OTE as 45, 46, and 47 (herbivores: dairy cattle; beef cattle and cattle breeding; beef and dairy cattle and cattle breeding), and the farms oriented towards small livestock (sheep and goats) are defined in the OTE as 48 (herbivores: sheep, goats, and other herbivores). Regarding UGT, the focus is exclusively on livestock farms. Consequently, a rational limit was established for these farms, contingent on a minimum of 10 UGT, which is equivalent to 10 cattle, 100 sheep, or 100 goats. Furthermore, a comprehensive record of characteristics such as experience, agricultural training, and attendance at training courses for all agricultural farm managers is maintained.

With the data disaggregated at the provincial level, an average farmer, differentiated by sex (male and female), has been created, with the variables offered by the INE. This process yields 100 livestock profiles, each characterized by unique attributes. A comprehensive analysis was conducted to calculate the characteristics of the average farmer related to age (AGE), family farm (FAM), size of farm by amount of livestock (UGT), type of livestock managed (LLS), experience (EXP), educational level (FORM), and attendance at training courses (COURSES). AGE, UGT, and EXP have been calculated by means of an arithmetic mean of the farmers of each sex in each province. In the case of UGT, the farms studied were limited to those with at least 10 UGT. The FAM, FORM, and COURSES have been calculated using percentages. In FAM, the number of farms where there is a family relationship between the owner and the head (whether the same person, spouse, or other member of the family) has been counted. In FORM, a weighted percentage has been calculated given an ordinal value between 0 and 1 at each of the four training levels (agricultural experience exclusively −0.00, courses −0.33, vocational training −0.67, and university studies −1.00). In COURSES, the percentage of farmers who have attended courses in the last year has been calculated. LLS is a characteristic formulated as the percentage of large livestock farms over the livestock as a whole, which indicates the orientation of the farm between large cattle (1.00) and small livestock (0.00). The dependent variable has been dichotomously coded as WOMAN for female subjects and MAN for male subjects. Utilizing these data, the JASP program has been employed to execute a logistic regression analysis. The dependent variable WOMAN has been constructed using the following independent variables: AGE, FAM, UGT, LLS, EXP, FORM, COURSES. Preliminary analysis indicated a high degree of multicollinearity, which compromised the stability of the model. Consequently, it was determined that the elimination of variables was necessary. The elimination of variables was guided by two criteria. Firstly, the variables were eliminated that reflected the characteristics of the heads of agricultural holdings in general (EXP, FORM, COURSES). Secondly, the best pseudo-R2 was identified. The EXT and FORM exhibited collinearity, and the latter was eliminated based on the pseudo-R2 criterion. Subsequently, we eliminated the non-significant variable ($p>0.05$) to refine the regression, eliminating COURSES.

2.3 Extensive Livestock Farming

A significant impediment to the study of extensive livestock farming in Spain is the absence of an official census that clearly differentiates it from intensive farming. In light of this limitation, the Extensive Livestock Farming Map (ELFM) is presented as the sole direct source available. It is a public database developed by the Platform for Extensive Livestock Farming and Pastoralism and the Entretantos Foundation. This database certifies farms as extensive through on-site visits that verify criteria such as a diet based on local pastures, a low level of livestock stabling, and environmentally sustainable management. As of December 2025, 78 farms had been certified, though the total size of the sector remains unknown.

The territorial distribution of the ELFM is significant in certain regions, including Castilla y León, Aragon, Extremadura, and Castilla-La Mancha, while in other regions with significant livestock production, such as Galicia, the ELFM is underrepresented. The relative abundance of farms in each region is illustrated by the percentage of farms present in each area, as shown in Figure 1.

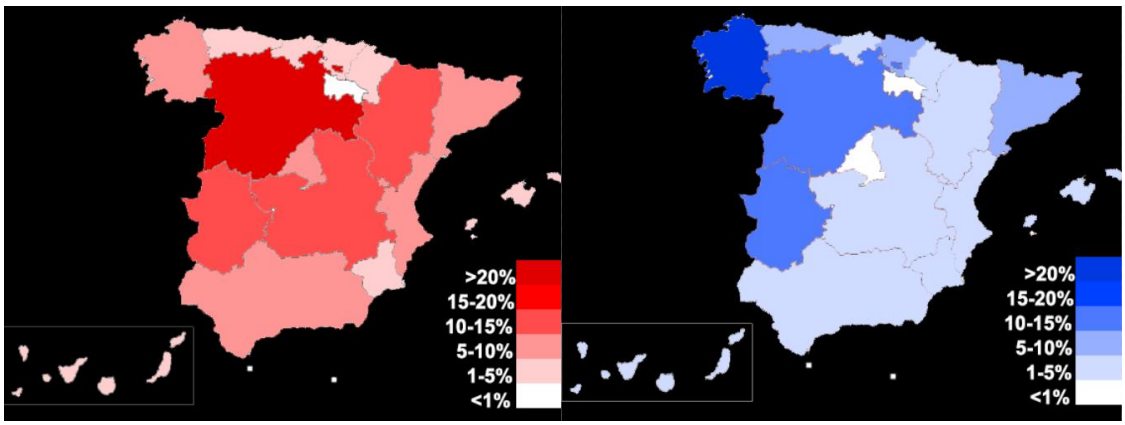

Figure 1. Distribution of livestock farmers among the regions, according to the ELFM (red) and the total livestock data from the 2020 Agricultural Census (blue)

Author's elaboration based on ELFM and INE.

To obtain data from extensive livestock farmers, brief surveys were carried out. Surveys were sent to the 78 registered farms in the ELFM, obtaining a response rate of 90% (70 farms), while eight of them did not participate. The surveys asked open-ended questions about the farmer's sex, age, region, type of livestock, number of livestock managed, experience, and whether the farm was a family business.

The ELFM exhibits a relatively high rate of female participation. This result has two plausible interpretations. First, the sample may be representative of extensive livestock farming. This would validate the farmers' statements about the historical role of women in extensive livestock farming (Menor-de-Gaspar López, Carrasco-Monteagudo & Gómez-Borja, 2025) and their interest in environmental resilience (Balezentis et al., 2021; Bock, 2004; Heather et al., 2005). Second, it should be considered that the sample is not representative, with a bias toward participants who are more receptive to new initiatives. This would imply that female participation in extensive livestock farming does not differ substantially from participation in livestock farming in general. In this case, the overrepresentation of women could be an indicator of diversification and innovation. In the absence of data on extensive livestock farming as a whole, we assume that the sample is representative.

The objective of this survey was to identify the variables that were significant in the model carried out for general livestock farming. Accordingly, the survey's content encompassed the following domains: sex (WOMANext), age (AGEext), family-owned farm (FAMext), number of livestock managed (UGText), type of livestock managed (LLSext), and accumulated experience (EXPext). The dependent variables WOMANext and FAMext have been dichotomously coded as follows: woman = 1, man = 0, and family-owned = 1, non-family-owned = 0. The variables AGEext and EXPext were directly the response provided by the respondent in years. The UGText and LLSext variables were coded on a spectrum ranging from 0 to 1. The size of the farm was categorized as small (0), medium (0.5), or large (1). The orientation of the farm was classified as small cattle (0), mixed cattle (0.5), or large cattle (1).

A logistic regression was conducted using the JASP software. The FAMext variable has been eliminated, given that all respondents indicated their farm was family-owned and family-managed. The dependent variable WOMANext has been constructed using the following independent variables: AGEext, UGText, LLSext, EXPext.

3. Results

The findings obtained lend support to the initial hypothesis that there are differences in the participation of men and women in the various sectors of agriculture. Validating this hypothesis suggests that each agricultural sector has specific characteristics that favor or hinder women participation. As demonstrated in Figure 2, while the phenomenon of masculinization is evident in agricultural activities as a whole, substantial variations are apparent among the various subsectors. For instance, a discrepancy in female participation was observed between mixed livestock farming (32.8%) and livestock farming with granivores (20.6%). Notably, only mixed livestock farming and farms classified as having zero production (31.3%) exhibited higher percentages of female participation compared to the subsector of livestock farming with herbivores (29.9%).

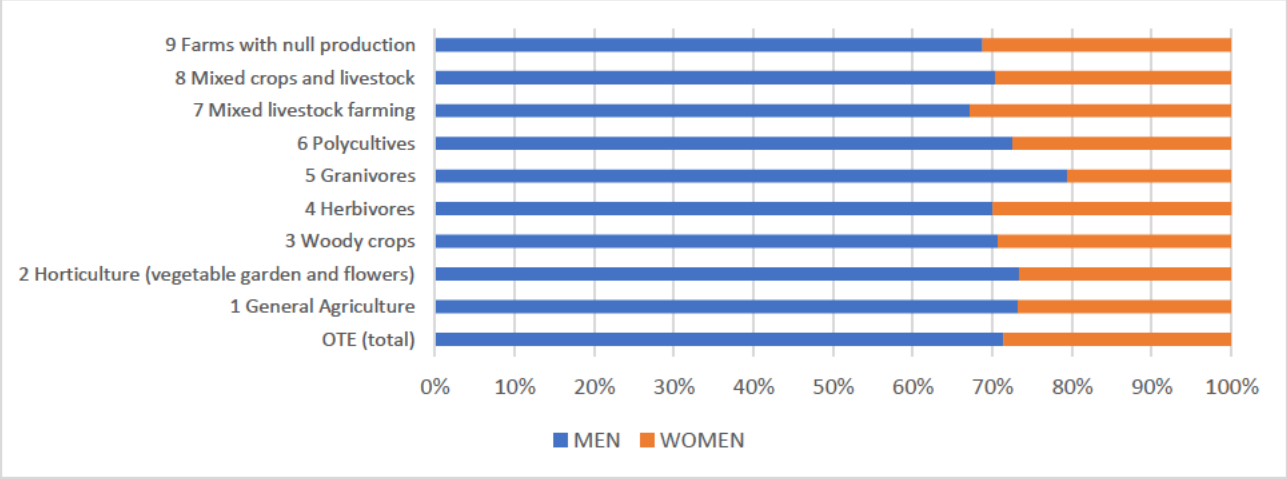

Figure 2. Participation by sex in each agricultural branch, according to the technical-economic orientation (OTE)

In herbivore livestock farming, specifically with cattle, sheep, and goats, the rate of female participation appears to be correlated with the proportion of women in the area. This explains 34.5% of the variation (see Figure 3), suggesting that even a slight change in the female population can lead to a significant increase in the female agricultural workforce. However, there is no correlation between the educational level of female livestock farmers and the educational level of women in the general population (0.1%). Additionally, there is a weak correlation in terms of age (5.7%) across the regions. In Figure 4 we observe that there is no correlation between female participation and the region's GDP per capita.

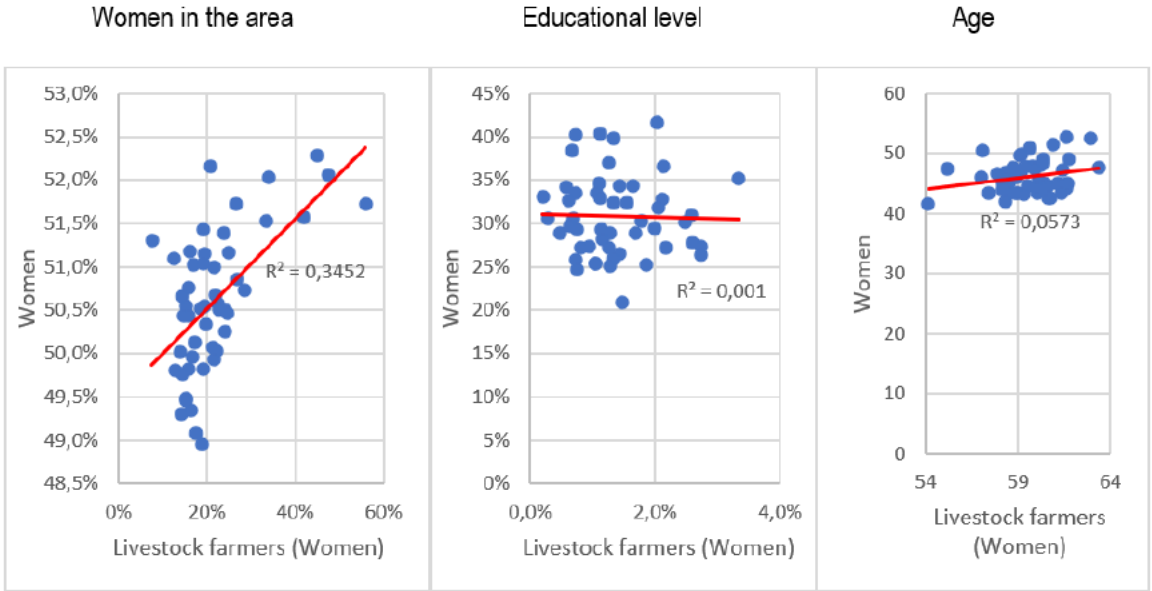

Figure 3. Participation, superior studies, and age of women in population and in livestock farming

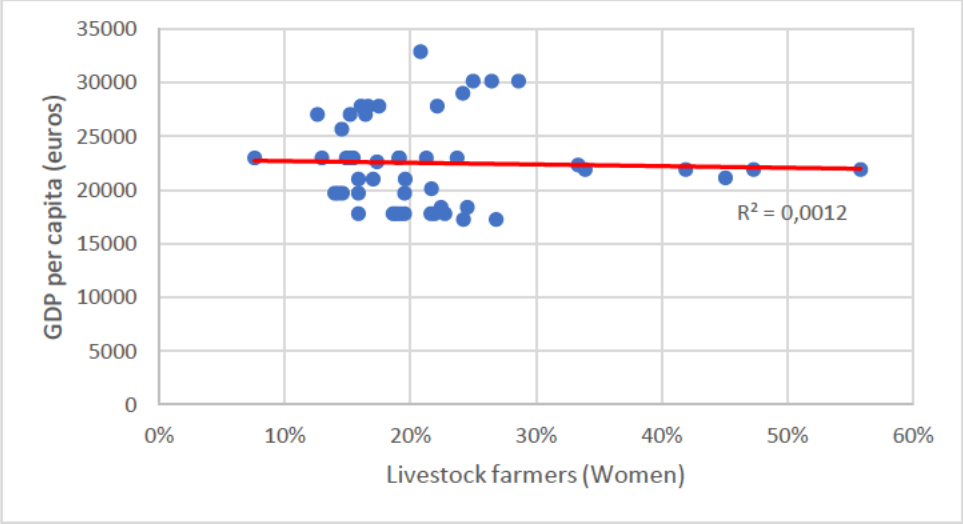

Figure 4. Participation of women in livestock farming and regional GDP per capita

A comparison of general and extensive livestock farming reveals notable variations in the demographic structure by sex (Figure 5). Female participation in general livestock farming stands at 29.9%, while in extensive livestock farming this proportion rises to 45.7%, which denotes a significantly higher female incorporation in the latter segment.

A comparison of the mean age differences for different types of livestock reveals that general livestock exhibits a slightly wider average age difference (Figure 6). In both groups, women exhibit a higher mean age: 56.3 years for women and 53.9 years for men in general livestock farming, and 46.4 years for women compared to 45.1 years for men in extensive livestock farming. Livestock farmers engaged in extensive livestock farming are, on average, approximately ten years younger than the general group. With respect to professional experience, men have a longer career in both contexts (20.4 and 27.9 years, respectively) compared to women (17.4 and 16.4 years, respectively). However, the discrepancy in experience is more pronounced in extensive livestock farming, which can be interpreted as an indicator of the more recent incorporation of women from other labor sectors.

Regarding farm size, measured in total livestock units (UGT), the average farm managed by men is considerably larger (160.9 UGT) than the average farm managed by women (109.4 UGT) in general livestock farming. The dimensions of these enclosures far exceed the size of conventional extensive livestock farms. In contrast, women manage farms of marginally greater size (65.6 UGT) compared to men (64.5 UGT).

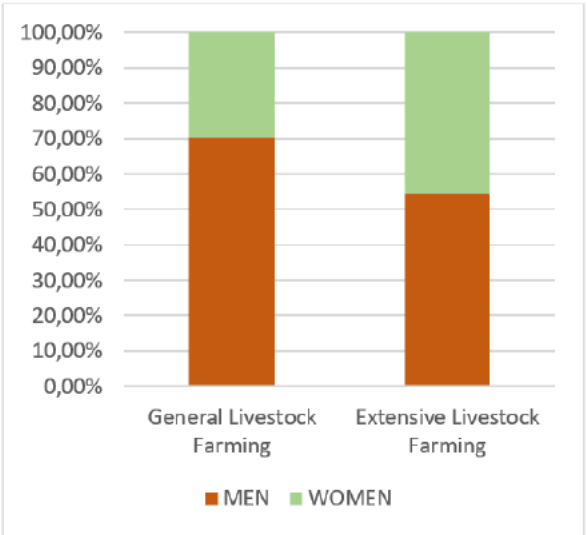

Figure 5. Participation by sex and type of management

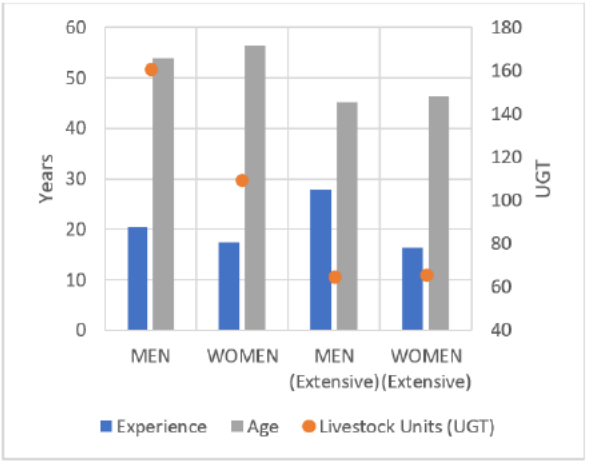

Figure 6. Age, experience, and size of farm, by sex and type

The analysis of livestock species (Figure 7) reveals that women who manage livestock on average oversee a higher proportion of cattle (72.1%) compared to men (59.2%). In extensive livestock farming systems, the management of cattle is less prevalent, with sheep and goat management being more predominant, particularly by female agriculturalists. Among the male population engaged in extensive livestock farming, 50.0% are dedicated exclusively to cattle, while 44.7% are exclusively dedicated to small livestock, with the remaining percentage engaged in mixed farms. The preference for small cattle is more pronounced among women, with a 68.8% prevalence, while only 25.0% of respondents exclusively manage cattle. A high prevalence of family farms is observed in general livestock farming, particularly among women. Specifically, 85.5% of men have a direct family relationship with the farm's owner, while this relationship is 92.4% among female farmers. In extensive livestock farming, all farmers reported that their farms were family-owned.



Figure 7. Family nature of the farm and species of livestock, by sex and type

It should also be noted that there are differences between men and women in terms of incorporation among extensive livestock farmers. Figure 8 shows that three out of four male farmers start the activity before turning 25, and 97% start before turning 35. In contrast, fewer than one-third of women join before the age of 25, more than one-third between 25 and 34 years of age, and approximately one-third after the age of 35. There is a discernible correlation between the two variables across diverse activities, which are categorized based on their technical-economic orientation (see Figure 9). This correlation does not adequately account for the disproportionate participation of women in specific activities, but it can explain 17.7% of the variation.

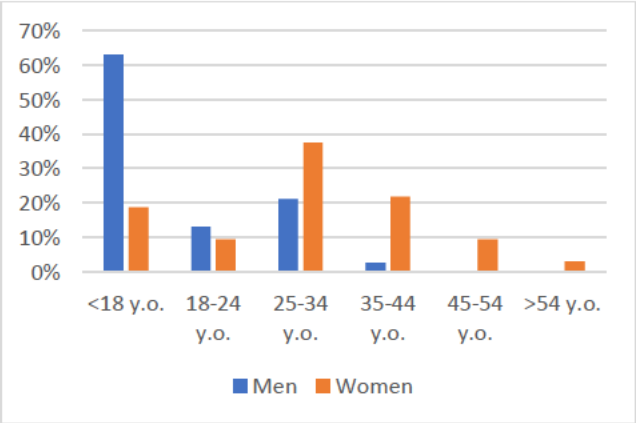

Figure 8. Age of incorporation, by sex

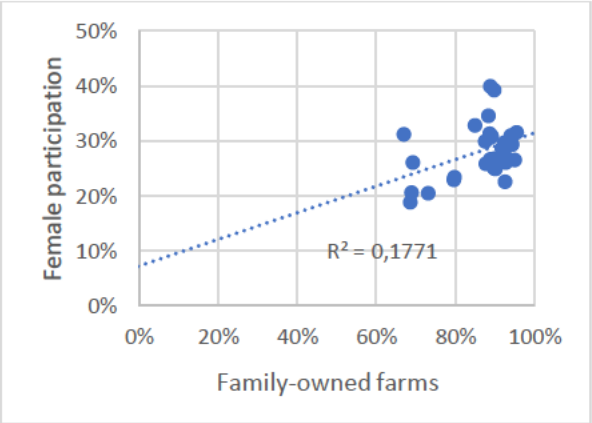

Figure 9. Female participation and participation of family farms in sub-branches of agricultural activity, by OTE

The findings of this study indicated that logistic regressions were significant ($p < 0.001$) in both groups. As illustrated in Tables 3 and 4, the results of Models A (general livestock farming) and B (extensive livestock farming) are presented. In model A, the regression demonstrates a high degree of predictive capacity, as evi-

denced by its high pseudo-R2 value. In the case of model B, a McFadden pseudo-R2 over 0.20 demonstrates a good fit of the model (Louviere et al., 2000), thus indicating its adequate predictive capacity.

In model A, all variables are statistically significant as the p-value < 0.05. The correlation between female farmers and certain demographic and economic characteristics of farms is well documented. These include advanced age, limited experience, increased farm size, the management of livestock, and a typology of family farms. In model B, the significance of managed livestock and farm size is marginal, yet it maintains an effect on regression ($p < 0.1$). In this model, women are associated with advanced age, limited experience, larger farm size, and smaller livestock.

Table 3. Model A: general livestock farming

Model	Deviance	AIC	BIC	Df	ΔX²	p	McFadden R²	Nagelkerke R²	Tjur R²	C&S R²
M_0	137.23	139.233	141.828	98			0.000		0.000	
M_1	31.66	43.662	59.232	93	105.571	< .001	0.769	0.874	0.799	0.656

						Wald Test		
Model		Estimate	Standard Error	Odds Ratio	z	Wald Statistic	df	p
M_0	(Intercept)	-0.020	0.201	0.980	-0.101	0.010	1	.920
M_1	(Intercept)	-26.077	15.180	4.732×10^{-12}	-1.718	2.951	1	.086
	EXP	-2.917	0.755	0.054	-3.863	14.926	1	< .001
	GMAY	7.559	2.668	1,918.616	2.833	8.027	1	.005
	AGE	0.937	0.313	2.552	2.993	8.956	1	.003
	UGT	0.029	0.013	1.029	2.211	4.888	1	.027
	FAM	26.126	9.809	$2.221\times10^{+11}$	2.664	7.095	1	.008

Table 4. Model B: extensive livestock farming

Model	Deviance	AIC	BIC	df	ΔX²	p	McFadden R²	Nagelkerke R²	Tjur R²	C&S R²
M_0	96.53	98.526	100.774	69			0.000		0.000	
M_1	71.60	81.601	92.843	65	24.925	< .001	0.258	0.400	0.321	0.300

Model		Estimate	Standard Error	Odds Ratio	z	Wald Statistic	df	p
M_0	(Intercept)	-0.172	0.240	0.842	-0.716	0.513	1	.474
M_1	(Intercept)	-1.293	1.290	0.274	-1.002	1.004	1	.316
	AGEext	0.078	0.034	1.081	2.289	5.240	1	.022
	GMAYext	-1.098	0.655	0.333	-1.676	2.808	1	.094
	UGText	1.442	0.855	4.228	1.686	2.843	1	.092
	EXPext	-0.113	0.031	0.893	-3.678	13.526	1	< .001

4. Discussion

The presence of women in the primary sector varies substantially among the different sub-sectors of agriculture. When analyzing the group of women livestock farmers, it is observed that this group does not replicate the average dynamics of the society in which it is inserted, especially in variables such as the age of access or the level of studies achieved. Although the data suggest a statistical relationship between the number of women in the general population and their participation in livestock farming, this link is questionable. Although a demonstrated correlation of 34.5% exists, the notable stability of female demographic figures across different regions, despite the fluctuating impact they have on livestock farming, suggests that the population factor is not the only determining factor. This phenomenon invites us to consider cultural and structural variables that go beyond mere demographic availability.

The statistical comparison is revealing: women participation is significantly higher in extensive livestock farming (45.7%) than in general livestock farming (29.9%). When these data are contrasted with the occupational rate by sex, it is observed that extensive livestock farming is less than half a percentage point from the 46.1% female participation rate in the total labor market. These indicators validate the thesis that women are a pillar of extensive livestock farming (Courdin, 2021; Litre et al., 2021; Menor-de-Gaspar López, Carrasco-Monteagudo & Gómez-Borja, 2025).

In line with observations made in various Latin American countries, family ties emerge as a determining factor. Women may be taking over the generational transition of cattle farms in rural areas as a strategy to preserve their heritage and way of life (Litre et al., 2021). This hypothesis gains strength when observing a 17.7% correlation between female participation and the prevalence of family businesses in different agricultural sectors. This scenario aligns closely with Polachek's (1981) postulates on family conciliation. The family business structure allows for the management of daily workloads that facilitate compatibility with domestic responsibilities. In fact, all extensive livestock farmers surveyed report operating under this family model. However, an ambiguity regarding causality arises: the lower profitability of extensive farms necessitates reliance on cohesive family support (Menor-de-Gaspar López, Carrasco-Monteagudo & Gómez-Borja, 2025). Thus, it is unclear whether the family model is drawn to extensive livestock farming due to a better work-life balance or if the low productivity and returns force the adoption of a family business model to ensure the activity's viability.

On the other hand, women tend to be more closely tied to family structures. While men tend to join agricultural activities at a young age, women tend to enter later: two-thirds of them join after the age of 35. This data reinforces the argument that women prioritize family care, opting for extensive livestock farming later in life as a way to balance childcare with employment (Choi, 2000; Lázaro et al., 2004). Additionally, experience has shown that a significant proportion of women entering the sector do not have strong ties to the activity. They are older on average and consequently have different entrepreneurial profiles than those of classic generational succession.

Beyond conciliation, women participation can be linked to extensive livestock farming through the adoption of more sustainable practices and greater resilience to climate change (Balezentis et al., 2021; Heather et al., 2005). Additionally, the size of the farm plays an important role: in general livestock farming, farms managed by women are smaller than those managed by men, but in extensive livestock farming, the sizes are similar regardless of sex. This suggests that the extensive model offers a more equitable environment, possibly because managing large herds in an intensive manner requires significant physical effort or workload, making it difficult to reconcile. Consistent with this, women's preference for types of livestock in each management system is more pronounced: in extensive livestock farming, they opt for smaller livestock (sheep and goats), while in general livestock farming, they focus on larger livestock (cattle). Again, the reasons may be related to the capacity for innovation and adaptation to physical demands. In contexts where mechanization is possible, women lead the

implementation of technology; where mechanization is not viable, smaller livestock allows for more autonomous and efficient management of physical labor (Balezentis et al., 2021; De Rosa et al., 2021).

The aforementioned factors were precisely the differentiating elements analyzed in the regression. Both Model A (general livestock) and Model B (extensive livestock) showed robust statistical adjustment and high explanatory capacity. For both models, a greater age, less experience, and a smaller size of the farm were important. In general livestock farming, the fundamental predictors were the family nature of the enterprise and the management of large livestock. In the case of extensive livestock farming, it is associated with small livestock, although its significance is limited. The studied phenomenon is more predictable in general livestock farming, as average profiles were used at the provincial level that represent the data from the Agricultural Census (N>110,000 farms), as opposed to the data obtained through the ELFM (N=70).

These factors can be partially associated with those reported in the literature. Given the fundamental importance of the family model and age, the significance of symbolic power within the family is validated, as well as the importance of the size of the operation and, to some extent, the presence of labor support, provided it is linked to the support of the family itself and not to the worker's own experience (Courdin, 2021). Diversification was validated through the size of the exploitation, in line with the findings of De Rosa et al. (2021), and sustainable practices justify greater participation in extensive livestock farming, while the association factor was not verified (Litre et al., 2021). In terms of attending courses, the only data that could be verified in associationalism, no correlation was found, although it is true that said attendance is neither a necessary nor sufficient condition for association and only shows a possible manifestation or interest in association. Finally, the factors proposed by Buendía-Martínez & Carrasco (2013) in terms of experience, training, and attendance at courses were not verified. It should be noted, however, that concepts such as female empowerment and entrepreneurial level are broad and multidimensional.

In this way, we have satisfactorily answered the two research questions posed: i) How do women participate in livestock farming, and more specifically, in extensive livestock farming, in Spain? and ii) What factors are associated with this participation? The data obtained are of special relevance not only for the Spanish context, but also for other contexts. Similarities in social structure, customs, and level of development mean that the conclusions of this study are valid not only for Spain, but also for other European countries (especially those in southern Europe, such as Portugal, Italy, and Greece) and South American countries with a high level of development (Uruguay, Brazil, and Argentina). The decline of extensive livestock farming in Europe (Pardini & Nori, 2011; Pinto et al., 2023; Ríos-Núñez & Coq-Huelva, 2015; Sa Rego et al., 2022) and South America (Febrer et al., 2021; Menor-de-Gaspar López, Carrasco-Monteagudo, Gómez-Borja, et al., 2025; Nin-Pratt et al., 2019) calls for action.

The achievement of the Sustainable Development Goals is a global objective. Promoting extensive livestock farming improves gender equality by supporting an area with high parity within a traditionally male-dominated sector. This can lead to other benefits, such as the augmentation of global productive capacity (Morais Maceira, 2017), with female entrepreneurship being especially significant (Buendía-Martínez & Carrasco, 2013; Mari & Pogessi, 2024; Mari et al., 2024). However, fundamentally, it can incorporate the achievement of other objectives related to climate resilience and territorial development thanks to the benefits that extensive livestock farming offers (Barron et al., 2021; Celaya et al., 2022; Deléglise et al., 2019; Dwyer, 2022; Lasanta et al., 2022; Salachna et al., 2022). Therefore, decisive political action is needed to defend extensive livestock farming and improve women participation in agricultural production.

5. Conclusions

This research concludes that extensive livestock farming is a bastion of gender equality in the Spanish primary sector. It achieves a female participation rate of 45.7%, approaching parity in the general labor market and significantly exceeding the 29.9% rate in conventional livestock farming. This phenomenon is not solely due to demographic availability; rather, it is based on the structure of the family business. This structure acts as a work-life balance mechanism, allowing women to raise children and maintain the business simultaneously. These findings can be extrapolated to other countries in southern Europe or South America given their demographic and economic similarities. The extant literature suggests that female participation in extensive livestock farming is a salient factor in the resilience of the sector. This finding lends credence to the need for public policies that are aimed at encouraging this production model and facilitating livestock entrepreneurship, according to SDGs. Such policies should include training programs, access to financing, and technical assistance. The notable presence of women in recent initiatives can be interpreted as an indicator of openness to innovation. This suggests the advantage of designing policies that link female entrepreneurship with diversification, digitalization, and sustainability projects, framed in an environmentally responsible rural development strategy. The delayed and less frequent entry of women into the field, which is characterized by a paucity of specialized training opportunities and the presence of age-based restrictions on the awarding of grants, underscores the necessity for the implementation of policies that can address these issues. Women's involvement in the agricultural sector has been demonstrated to yield economic, environmental, and social benefits. Therefore, it is imperative to explore strategies that would further augment these benefits, particularly in the context of the extensive livestock sector.

This study addresses a methodological limitation that is pervasive in research focused on extensive livestock farming: the absence of systematic statistical data on the sector. The primary constraint pertains to the representativeness of the surveys conducted. The absence of a census hinders the execution of a comprehensive analysis, thereby impeding the identification of underlying dynamics and mechanisms. Consequently, the formulation of more precise and effective public policies is hindered. Therefore, future research must incorporate additional parameters that delve into family status and inheritance regimes, as well as factors associated with entrepreneurship, associationism, and female empowerment, as well as other relevant variables such as the number of children, perceived workload, or marital status. Moreover, it should expand the representativeness of the samples to better understand the evolution of a sector that, in the group analyzed, shows a desirable gender parity for the agricultural sector as a whole. The viability of the rural economy is contingent upon the active involvement of the entire population, no matter the sex they have.

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Use of Artificial Intelligence

DeepL was used for supporting the translation and stylistic correction of this work into English. Careful validation was manually done by the author.

Transparency of Data

Available data: The entire data set that supports the results of this study was published in the article itself.

Author Contribution Statement

	R Menor-de-Gaspar-Lopez	I Carrasco-Monteagudo
Conceptualization	■	
Data curation	■	
Formal analysis	■	
Funding acquisition	■	
Investigation	■	
Methodology	■	
Project administration	■	
Resources	■	■
Software	■	
Supervision	■	
Validation	■	■
Visualization	■	■
Writing – original draft	■	
Writing – review and editing	■	■

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