Assessment of psychosocial risks faced by workers in Almería-type greenhouses, using the Mini Psychosocial Factor method

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A B S T R A C T

This work reports the use of the Mini Psychosocial Factor (MPF) method for assessing the psychosocial risks faced by agricultural workers in the greenhouses of Almería (Spain) with the aim of improving their health. The variables Rhythm, Mobbing, Relationships, Health, Recognition, Autonomy, Emotional Involvement, Support, Compensation, Control, Demands, and Mental Load were recorded using a pre-validated questionnaire containing 15 questions. The sex, age, and nationality of the respondents ($n = 310$) were also recorded, as were the type of greenhouse in which each worked, the size of the greenhouse, and the crop grown. The results showed psychosocial risks to exist for the workers. Multiple correspondence analysis, however, showed that moderate risks can be offset by new prevention pro-grammes that improve Spanish legislation in terms of workers' salaries, worker—employer social days, work timetables to facilitate family life, and training courses. This could improve the work environment and health of Almería's greenhouse workers as well as their productivity.

1. Introduction

The world agro-food system has been globalized and it is important not only for the volume of commerce generated but also, given its diverse and complex nature, it has far-reaching dimensions: social cultural, political, and environmental. The internationalization of European agro-food companies make it necessary to seek ways that guarantee its viability as well as competitiveness with non-European countries where the labour costs (wages) are far lower. Moreover, to strengthen the competitiveness of the companies, the governments of developed countries draw up new labour contracts that could leave workers in more precarious situations than before (Potter and Tilzey, 2005). Fair work regulations for all workers, including immigrants would fall within the responsibility of governments, syndicates, and international organizations (Blas et al., 2008; Benach et al., 2011). Also, they should pay special attention to precarious work (seasonal work, little knowledge of the position, little work experience, immigrant workers, etc.; Benach and Muntaner, 2007), as this is directly related to the mental health of the workers (Vives et al., 2011) and accidents on the job (Brower et al., 2009; Benavides et al., 2006).

If we add to this that almost all the technical measures being adopted to maintain or boost the economic viability of agricultural production in developed countries are aimed at developing new, more productive plant varieties, to improve environmental conditions of the crops (ventilation, radiation, humidity, heating) and to optimize the nutrient supply to the plants, all this based on sustainability (Westhoek et al., 2006), we find that few studies, in comparison with other productive sectors, are directed at improving the working conditions for European agricultural workers, and even less for those of the horticultural sector of the south-eastern Western Europe.

Authors such as Vega et al. (1985) studied the psychosocial risks of Mexican agricultural workers in the United States, concluding that plans for preventive medicine were needed. Later, studying the same group of workers, Hovey and Magana (2002) again studied the psychosocial risks of these workers, identifying high levels of anxiety and depression. The main causes were the problems between the different cultures, family group, lack of social support, and low self-esteem. The authors recommended the establishment of prevention and treatment services for immigrant workers in order to raise the level of emotional support, self esteem, and the ability to cope with new living conditions.

Also, Hoglund (1990) explained that at the end of the 1980s, in Sweden, a preventive network for agricultural workers was established, requiring a medical examination every two years, and controls were begun for psychosocial risk, as this was identified as an emerging risk. This same concept of emerging risk in the agricultural sector has been examined more recently by Bernard et al. (2007), but this researcher did not restrict the study to limited

labour stress but also included mental disorders associated with professional activity. Other authors describe the psychosocial risks in agriculture as those that influence stress, economic problems, and access to medical attention, relating these directly with the costs that this could represent for companies in the form of worker absence and medical insurance (Ehlers et al., 1993).

Also, at the end of the 1990s, Thelin (1998), using psychosocial indices to investigate working conditions in rural areas of Sweden, highlighted that women had less motivation in the workplace and more worry for their future than did the men. On the contrary, the men had higher psychological demands. Also, this study showed that the better state of health of the agricultural workers could be due to the good psychosocial environment of the workplace. A similar conclusion was reached in the French meat sector by Cohidon et al. (2009), concluding that physical and psychological health was conditioned by the organizational limitations of companies.

A notable detail observed by many researchers (Fathallah, 2010; Bernard et al., 2011) concerns the direct relations between the muscular–skeletal problems and psychosocial disorders, the latter being a reliable warning of the future onset of the former. The same conclusion was reached by Chapman et al. (2004), Habib and Fathallah (2012), and Abrahao et al. (2012) but specifically in the horticultural sector. Cross et al. (2009) compared the psychosocial and agricultural risks of those working with fruits and vegetables in the United Kingdom, Spain, Kenya, and Uganda. The results indicated that the perception of the state of health of the African workers was far better than that of the European workers. The authors concluded that this result was due to the social conditions of the workers than to company benefits.

Also, the wellbeing, or lack thereof, among young agricultural workers and immigrants can be affected by problems due to mobility, poverty, cultural differences, migrant status, language, education, dwelling, food safety, legislation, access to childcare and health assistance (McLaurin and Liebman, 2012).

Greenhouse work is generally recognized as being arduous. Studies on work, the working conditions, workers' physical and mental health, and skill learning potential etc. was studied in greenhouse agriculture in the 1980s (Gustafsson and Lundqvist, 1982). Interest in the occupational health and safety of agricultural and horticultural (greenhouse) workers came later, highlighting the physiological, physical, biological, chemical and psychosociological risks in this sector (Lundqvist, 2000). The same risks have been examined with respect to Swedish farmers (Kolstrup et al., 2008), and with respect to the age of agricultural workers (Nilsson et al., 2010). These latter four studies demonstrate that agricultural tasks were gratifying for Swedish workers, although certain ergonomic improvements could be made.

In Almería, research has examined risk prevention in greenhouses of the type commonly used in that province (García and Padilla, 2005). This study underscored the need to pay attention to the risks related to work organization and personal relationships, especially when workers are of different nationality (perhaps leading to cultural conflicts) and communication difficulties. The latest work has examined the use of the LEST methodology (Guélaud et al., 1975) in Almería-type greenhouses to detect problems (Callejón-Ferre et al., 2009b, 2011b). The LEST is a method of general evaluation using a questionnaire, with 16 variables grouped in 5 areas (all variables being measured on a scale of 0–10):

1) Physical environment: thermal environment, lighting, noise, and vibrations.
2) Physical workload: static and dynamic.
3) Mental workload: time pressure, complexity-speed, attention, and thoroughness.
4) Psychosocial aspects: Initiative, social status, communication, cooperation, and identification with the product.
5) Working hours.

The LEST method explains roughly the possible ergonomic problems, but does not evaluate them in depth, thus requiring the use of more specific ergonomic methods in each study area.

Using a general ergonomic-assessment model (LEST method), Callejón-Ferre et al. (2009b, 2011b) detected potential problems related to thermal stress, psychosocial risks, and physical load (in that order of importance). The problems of thermal stress were examined in detail in a previous paper (Callejón-Ferre et al., 2011a).

Research has also been undertaken on the working conditions outside greenhouses to help prevent risks to construction workers building Almería-type greenhouses (Pérez-Alonso et al., 2011b), including actual construction accidents (Pérez-Alonso et al., 2012) and thermal stress (Pérez-Alonso et al., 2011a).

Of the many psychosocial risk-assessment methods, the six most commonly used in Spain are shown in Table 1. All have been validated for use in Spain, the choice depending on the aim of the study, the workers involved, and the work performed.

The aim of the present study was to assess the psychosocial risks (which fall within the field of organizational ergonomics as described by Sebastián (2008)) faced by workers in Almería-type greenhouses, using the Mini Psychosocial Factor (MPF) method.

2. Material and methods

2.1. Study area

Roughly three million people work in greenhouses worldwide, of which some 45,000 (Callejón-Ferre et al., 2009b) work in Almería, Spain (Fig. 1), where the greatest concentration of greenhouses of Europe covers approximately 25,902 ha (Sanjuán, 2007).

The greenhouses of Almería are mainly (96.5%) of the "*plano* (flat)" and "*raspa y amagado*" types (Fernández and Pérez, 2004), which together are referred to as "Almería-type" greenhouses (Fig. 2).

Tomatoes, lettuce, peppers, melons, water melons, aubergines, courgettes, cucumbers, and beans are all grown in these greenhouses, as well as ornamental plants in small numbers (Castilla, 2005). The total yield reaches €1600 million per year, with labour costs comprising 40% of the total production cost per ha (Cabrera-Sánchez and Uclés-Aguilera, 2011).

2.2. Labour characteristics of the workers

Greenhouses in south-eastern Spain are either family operated or hire help on a fixed salary or seasonal wage (Céspedes-López et al., 2009).

Family workers of the greenhouse business usually includes the owner, the spouse, and the children. This labour is characterized by its high degree of commitment to the greenhouse work, repre-senting about 40% of the labour needed per crop. Nevertheless, this declines sharply (25%) in greenhouse operations covering more than 2 ha.

Fixed salaries are paid to permanent workers in the greenhouse, from the 9 months that the crop cycle normally lasts up to 12 months (including one month of vacations and maintenance work). This type of worker covers about 35% of the total labour. Also, this percentage rises to some 40% in greenhouse operations of more than 2 ha.

Seasonal wages are paid to temporary workers to cover specific crop needs, especially harvest and cleaning at the end of the crop cycle. This work usually lasts 3–6 months, covering around 25% of

Table 1
Comparison of psychosocial risk-assessment methods.

Method	Number of items	Variables studied		
FPSICO (Martín-Daza and Pérez-Lilbao, 1997)	75	Mental load Autonomy (time) Work content	Supervision–participation Definition of role	Interest in work Personal relationships
ISTAS21 (Moncada et al., 2004)	>38, depending on the version	Psychological demands Feeling of belonging to the company and opportunity of improving skills Social support, quality of leadership Insecurity		Labours at work and home Esteem Compensation
Mini Psychosocial Factor (MPF) (Ruíz and Idoate, 2005)	15	Rhythm Mobbing Relationships Health	Recognition Autonomy Emotional involvement Support	Compensation Control Demands Mental load
FP-ISR (Lahera-Martín and Góngora-Yerro, 2002)	30	Participation, involvement, responsibility Training, information, communication		Time management Group cohesion
PSICOMAP (INERMAP, 2004)	53	Distribution and design Communication	Control and leadership Mental load	Problems associated with night-shift work Social satisfaction Personal
RED-WONT (WONT, 2011)	195	Work demands Resources for working	Social resources	resources

the total labour needed. However, in operations exceeding 2 ha, this labour can reach 35% of the total.

Of all the non-Spanish farm workers employed (c. 37%), those of African origin (primarily Moroccans) are the most numerous, constituting some 60% of the total of immigrant farm workers, followed by workers from Eastern Europe (mainly Rumanians), with 22%, and Hispano-Americans (chiefly Equadorians), with11% (Cabrera-Sánchez and Uclés-Aguilera, 2011).

Finally, Spanish legislation (BOE, 1995) is adapted to the labour legislation of the European Union, obligating each farmer to hire service for labour-risk prevention for all specialities (job safety, industrial hygiene, ergonomics, applied psychology, and health watch), the workers have the right to a yearly medical examination in addition to obligatory job training every year. Also, all farm workers, whether foreign or not, are guaranteed a work contract, state health care, unemployment benefits, access to syndicates, and the same rights as all other Spanish (or EU) workers.

2.3. The assessment method

For the choice of methods, a decision matrix was used (Table 2), and in this way the methods described in Table 1 were scored from 1 to 4, choosing the one reaching the highest score.

In addition, because of the different nationalities of the workers studied (Cabrera-Sánchez and Uclés-Aguilera, 2011) and because they would be working while the study was being performed, the MPF method (Tables 1 and 2) was chosen for having the fewest questions ($n = 15$) but being capable of examining 12 variables (answers are provided on a scale of 1–10; see below). This method has been scientifically validated for use in Spain (Ruíz and Idoate, 2005). The FPSICO, ISTAS21 or RED-WONT tests might have provided better-quality results for having more questions, but the questioning would have been too time consuming given the sample size required (see below).

MPF is a good initial diagnostic method, being quick as well as statistically reliable and valid; in addition, it is ideal for studying populations (as in our case). On the contrary, it is less reliable than other methods (e.g. FPSICO, ISTAS21) because its few questions analyse many parameters—that is, other methods (Table 1) use more questions and evaluate fewer parameters, thus providing more robust and reliable results.

This method can be used in any Spanish work sector (industry, administration, agriculture, tourism, education, etc.) and examples of this with reliable results in improving the workplace include: Consejo Superior de Investigaciones Científicas de España (Higher Council for Scientific Research of Spain), University of Almería, ArcelorMittal, Navarro Health Service, Administrator to train infrastructure (Ruíz and Idoate, 2005).

The questions asked in the MPF questionnaire are outlined below.The MPF questionnaire

1. Are you in satisfactory health?
2. Are your relationships with your co-workers generally good?
3. Do you enjoy your work?
4. Do you have enough time to carry out your tasks?
5. Are you able to make decisions in your work?
6. Do you suffer any stress because of a co-worker?
7. Is your work commonly interrupted?
8. Are your efforts recognized by your superiors?
9. Do you have the right tools/other means to do your job?
10. Are you able to concentrate in your work?
11. Do you get too emotionally involved in your work?
12. Can you undertake your tasks at a reasonable rate?
13. Does any co-worker repeatedly mistreat any other?
14. Is your workload too heavy?
15. Do you have any means at your disposal that would help you improve your work?

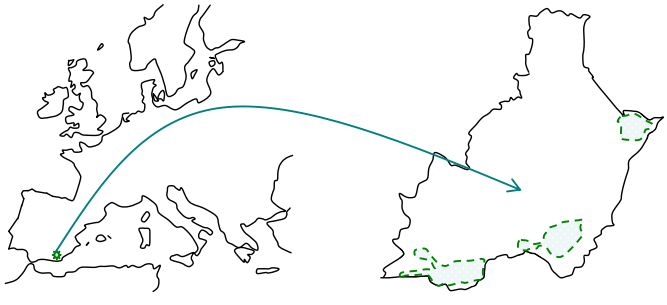

Fig. 1. Location of greenhouses in the Province of Almería, Spain (Callejón-Ferre et al., 2010).

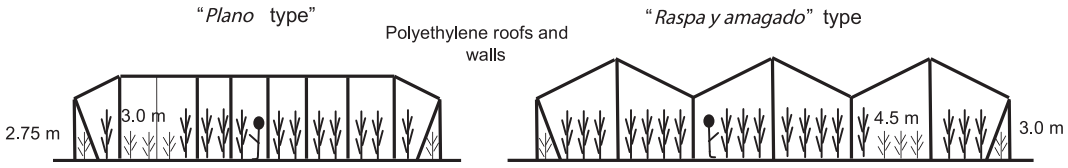

Fig. 2. Cross-section of the main greenhouses used in Almería (Callejón-Ferre et al., 2009a).

The answer scale runs as follows: 1not at all, 2 very, 3–4 poor, 5–6 normal, 7–8 quite good, and 9–10 good (or similar appropriate descriptions).

The scores recorded for these questions are then used to assess the following 12 variables:

1) **Rhythm (Rhy)**. The rhythm, or pace, of work to which the worker and corresponding group is subject. The volume of work, the pressure of time and interruptions of work are directly related to the psychological demands of the job. Related to questions 4 and 12.
2) **Mobbing (Mob)**. Related to the presence or absence of behavioural elements that can lead to the mobbing or hounding of people in a work group. Related to question 6 and 13.
3) **Relationships (Rel)**. This refers to the human and professional relationships between people making up work groups and their communication. This may include relationships with clients. Related to questions 2, 11, and 15.
4) **Health (Hea)**. The individual and group state of mental and physical health. Related to question 1.
5) **Recognition (Rec)**. The recognition on the part of superiors of the work performed and the achievements of workers. Related to question 8.
6) **Autonomy (Aut)**. The degree of autonomy workers are allowed to manage their work. Related to question 5.
7) **Emotional involvement (Emo)**. The degree of emotional involvement of workers in the undertaking of their tasks. Related to question 11.
8) **Support (Sup)**. The degree of support received from management and co-workers encouraging basic harmony and respect, as well as organizational support to facilitate teamwork and to answer technical doubts. Related to questions 2 and 9.
9) **Compensation (Com)**. Compensation for work performed, the perception of client- and co-worker-derived esteem, status at work, moral and economic recognition, and the valuing of effort and competence. Related to questions 3 and 8.
10) **Control (Con)**. This refers to the possibility of developing skills, learning and degrees of skill needed to ensure appropriate responses to work demands. Related to questions 5 and 12.
11) **Demands (Dem)**. The psychological demands of the work. The volume of work, the time in which to perform tasks, and interference in executing tasks all place psychological demands on workers, as do the lack of adequate tools, dependence on third parties, products or organizations, etc. Related to ques-tions 4, 7, 10, and 14.
12) **Mental load (CM)**. The intellectual effort that a worker must exert to meet the demands of the work. The number of demands, the amount of information to be dealt with, the effort to remain focused, the assigned response time, the complexity and detail of the work performed, and the subjective percep-tion of its difficulty all affect the mental load. Its value depends on the results for Support, Control, Compensation, and Demands.

Table 2
Decision matrix for selecting the method.

Method (See Table 1)	Speed of filling out the questionnaire	Variables studied	Applicability in agriculture	Statistical reliability and ease	Total
FPSICO	2	3	3	4	12
ISTAS21	3	3	3	3	12
MPF	4	4	3	2	13
FP-ISR	3	3	3	3	12
PSICOMAP	2	3	2	3	10
RED-WONT	2	2	2	4	10

To facilitate this assessment, an Excel sheet provided by the authors of the MPF method was used to input the MPF question scores and thereby obtain scores for the 12 variables above (Table 3):

Thus, each of the 12 variables was allocated a risk value or category: high (H), medium (M) or low (L).

2.4. Sample size and data gathering

Since there are some 45,000 greenhouse workers in Almería (Callejón-Ferre et al., 2009b) the sample size required was determined as follows (Cochran, 1977; Hedayat and Sinha, 1991):

$$n = \frac{N \cdot Z_a^2 \cdot p \cdot q}{d^2 \cdot (N-1) + Z_a^2 \cdot p \cdot q}$$

where

N = the total population
Z_a = 1.962 at the 95% confidence level (95%CL), 1.645 at the 90% CL, 2.24 at the 97.5% CL, and 2.576 for the 99% CL.
p = the expected frequency; when this is unknown a value of 0.5 (50%) is used, maximizing the sample size.
$q = 1 - p$
d = acceptable error

Thus, if $d = 5.55\%$, the confidence level is 95%, and $p = 0.5$:

$$n = \frac{45000 \cdot 1.962^2 \cdot 0.5 \cdot 0.5}{0.0555^2 \cdot (45000 - 1) + 1.96^2 \cdot 0.5 \cdot 0.5} = 309.65$$

The sample size was therefore set at 310.

Table 3
Risk levels for the studied variables.

MPF method variables	Ratios
Rhythm, Mobbing, Relationships, Health, Recognition, Autonomy, Emotional involvement, Support, Compensation, Control	≥1 < 4 = High risk (H) ≥4 but ≤ 7 = Medium risk (M) >7 but ≤ 10 = Low risk (L)
Demands (of work)	≤1 < 4 = Low risk (L) ≥4 but ≤ 7 = Medium risk (M) >7 but ≤ 10 = High risk (H)
Mental load	≤1 < 7 = High risk (H) ≥7 but ≤ 14 = Medium risk (M) >14 but ≤ 20 = Low risk (L)

Data were collected between 02/Jan/2011 and 02/June/2011 in Almería-type greenhouses randomly selected (non-stratified) among those of the province. No more than two workers were interviewed per greenhouse. All had work contracts.

2.5. Qualitative and quantitative variables of the data analysis

Together with the 12 variables studied (the results being regarded as qualitative when expressed as H, M or L, but quantitative when represented by a numerical value) the qualitative data shown in Table 4 was collected for each worker.

A descriptive analysis was performed on both the qualitative and quantitative results. Multiple correspondence analysis was then performed to relate the risks faced by the workers with their qualitative characteristics.

2.6. Nomenclature

Table 5 summarizes all the nomenclature used in the present study.

3. Results

3.1. Sample description

Table 6 shows the means for the quantitative variables recorded by the MPF method. None reached the H risk level described in Table 3. Table 7 shows the modes and frequencies for the qualitative variables (including worker information) and their categories.

The mode for the variable sex was "ML", for age it was "T2", for greenhouse type "RyA", for greenhouse size "S1", for nationality "Spa", and for crop grown "Tom". For all other variables the mode was "M", except for Mobbing, which was "H".

3.2. Multiple-correspondence analysis

Multiple-correspondence analysis was performed on the variables in Table 7. The resulting model had two significant dimensions, the first explaining 19.8% of the variance with a Cronbach α coefficient of 0.762 and an autovalue of 3.564, and the second explaining 16.097% with a Cronbach α coefficient of 0.693 and an autovalue of 2.897. For the model as a whole, the total variance explained was 17.949%, the mean Cronbach α coefficient was 0.731, and the mean autovalue 3.231. The model can therefore be regarded as reliable.

Table 8 shows the discrimination values for each variable (the closer to 1, the better the value) with respect to each of the model's two dimensions. The first dimension showed mid-range discrimination values for the variables "Con" (0.514), "Rel" (0.449), "Aut" (0.409), "CM" (0.401), "Rec" (0.397), "Emo" (0.324), and "Com" (0.327), and low discrimination values for "N" (0.164), and "Dem" (0.145). The second dimension also showed mid-range discrimi-nation values for "Sup" (0.565), "Mob" (0.533), and "Rhy" (0.303), and low discrimination values for "C" (0.183), "SZ" (0.154), and "Hea" (0.145). For "SX", "A", and "TG", the discrimination values provided by both dimensions were very low.

Fig. 3 graphically represents the discrimination values of Table 8, indicating that most related variables are those with the narrowest angles between the lines at the origin.

Fig. 4 shows the relationship between all the categories of all the studied variables.

Quadrant I of Fig. 4 has 8 categories referring to worker characteristics (T2, RyA, Tom, T3, ML, Cou, His, and S1; see Table 5), which in most cases are associated with the risk categories Com-M, Con-M, Aut-M, CM-M, Sup-M, Rec-M, and Mob-M. Aut-L (see Table 5) is somewhat farther from the origin. Quadrant II has 2

Table 4
Qualitative variables collected for each worker.

Variable	Categories
Sex = SX	Male = ML Female = F
Age = A	T1 ≤ 25 years 25years < T2 ≤ 40 years T3 > 40 years
Nationality = N	Spanish = Spa African (Morocco, Nigeria, Mali, Senegal, Algeria, and Mauritania) = Afr Hispanic-Americans (Ecuador, Chile, Colombia, and Paraguay) = His Eastern Europe (Bulgaria, Rumania, and Lithuania) = EurE
Type of greenhouse = TG	*Plano* type = Pla *Raspa y amagado* type = RyA
Size of greenhouse = SZ	S1 ≤ 2 ha 2ha < S2 ≤ 4 ha S3 > 4 ha
Crop grown = C	Tomato = Tom Pepper = Pepp Cucumber = Cu Courgette = Cou

Table 5
Nomenclature.

Abbreviation	Description	Abbreviation	Description
H	High risk	S1	≤2 ha
M	Medium risk	S2	Between 2 and 4 ha
L	Low risk	S3	>4 ha
SX	Sex	Tom	Tomato
A	Age	Pepp	Pepper
N	Nationality	Cu	Cucumber
TG	Type of greenhouse	Cou	Courgette
SZ	Size of greenhouse	Rhy	Rhythm
C	Crop grown	Mob	Mobbing
ML	Male	Rel	Relationships
F	Female	Hea	Health
T1	≤25 years	Rec	Recognition
T2	Between 25 and 40 years	Aut	Autonomy
T3	>40 years	Emo	Emotional involvement
Spa	Spanish	CM	Mental load
Afr	African	Sup	Support
His	Hispanic-American	Com	Compensation
EurE	Eastern European	Con	Control
Pla	*Plano* type	Dem	Demands
RyA	*Raspa y amagado* type		

Table 6
Descriptive statistics of the quantitative variables recorded by the MPF method.

Variable	Minimum	Maximum	Mean	Risk level (see Table 3)	Standard deviation
Rhythm	3.00	9.50	5.91	M	1.39
Mobbing	1.00	10.00	4.52	M	3.00
Relationships	1.67	9.33	5.62	M	1.37
Health	1.00	10.00	6.64	M	1.94
Recognition	1.00	10.00	4.74	M	2.21
Autonomy	1.00	10.00	5.58	M	2.56
Emotional involvement	1.00	10.00	5.97	M	2.37
Mental load	4.42	18.00	10.17	M	2.70
Support	2.00	9.25	5.31	M	1.68
Compensation	1.50	10.00	5.10	M	1.60
Control	1.00	8.70	5.39	M	1.35
Demands	2.00	8.75	5.62	M	0.98

Table 7
Frequency and mode for the different qualitative variables (examined by category).

Variable	Category	Frequency	%	Variable	Category	Frequency	%
Sex	ML[a]	219	70.65	TG	Pla	125	40.32
	F	91	29.35		RyA[a]	185	59.68
Age	T1	84	27.10	SZ	S1[a]	176	56.77
	T2[a]	161	51.94		S2	66	21.29
	T3	65	20.97		S3	68	21.94
Nationality	Afr	89	28.71	C	Cou	47	15.16
	Spa[a]	181	58.39		Cu	17	5.48
	EurE	29	9.35		Pep	51	16.45
	His	11	3.55		Tom[a]	195	62.90
Rhy	H	20	6.45	Emo	H	49	15.81
	L	54	17.42		L	89	28.71
	M[a]	236	76.13		M[a]	172	55.48
Mob	H[a]	151	48.71	CM	H	37	11.94
	L	67	21.61		L	19	6.13
	M	92	29.68		M[a]	254	81.94
Rel	H	31	10.00	Sup	H	66	21.29
	L	38	12.26		L	61	19.68
	M[a]	241	77.74		M[a]	183	59.03
Hea	H	21	6.77	Com	H	67	21.61
	L	108	34.84		L	28	9.03
	M[a]	181	58.39		M[a]	215	69.35
Rec	H	95	30.65	Con	H	43	13.87
	L	41	13.23		L	21	6.77
	M[a]	174	56.13		M[a]	246	79.35
Aut	H	74	23.87	Dem	H	14	4.52
	L	82	26.45		L	11	3.55
	M[a]	154	49.68		M*	285	91.94

[a] Mode.

categories referring to worker characteristics Cu and Afr (see Table 5). These are close to the risk categories Sup-H, Mob-H, Hea-M, Rhy-M, Rel-M, while Dem-M. Emo-H and CM-H (see Table 5) are more distant. Quadrant III has 2 categories referring to the worker characteristics Spa and S3 (see Table 5), which are close to the risk categories Hea-H, Hea-L, and Emo-L but more distant from Com-L, Rec-L, Dem-H, Rel-L, Con-L, CM-L, and Rhy-L (see Table 5). Quadrant IV has six categories referring to worker characteristics EurE, F, Pla, S2, T1, and Pepp (see Table 5), which are close to the risk categories Com-H, Rec-H, Aut-H, Rhy-H, Con-H, Rel-H, Emo-M, and Dem-L, with Sup-L and Mob-L (see Table 5) more distant.

Finally, Fig. 4 shows three correspondence clusters: A, B, and C. Cluster A includes no qualitative worker variables (marked in red throughout Fig. 4); it includes only the qualitative variables of the MPF method (marked in black throughout Fig. 4). Clusters B and C contain, and therefore inter-relate, both types of variables.

Table 8
Discrimination values for the variables with respect to each dimension in multiple-correspondence analysis.

Variable	Dimension		
	1	2	Mean
SX	0.047	0.008	0.028
A	0.011	0.027	0.019
N	0.164	0.056	0.110
TG	0.025	0.016	0.021
SZ	0.014	0.154	0.084
C	0.054	0.183	0.118
Rhy	0.110	0.303	0.207
Mob	0.074	0.533	0.304
Rel	0.449	0.082	0.265
Hea	0.018	0.145	0.082
Rec	0.397	0.271	0.334
Aut	0.409	0.104	0.257
Emo	0.324	0.005	0.165
CM	0.401	0.125	0.263
Sup	0.079	0.565	0.322
Com	0.327	0.137	0.232
Con	0.514	0.152	0.333
Dem	0.145	0.032	0.088
Active total	3.564	2.897	3.231
% Variance	19.800	16.097	17.949

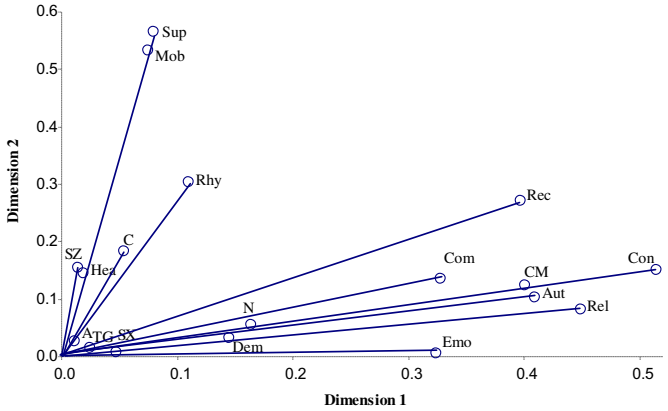

Fig. 3. Relationships between the discrimination values of the variables studied as determined by multiple-correspondence analysis.

4. Discussion

Table 6 shows the mean risk level for all the variables evaluated by the MPF method to be M. Table 7 shows the majority of greenhouses workers to be men (ML), that the *raspa y amagado* (RyA) greenhouse type is the most common, that most workers are under 40 years of age (T1 and T2), that the size of the greenhouse operation is usually equal to or less than 2 ha (S1), that the majority of workers are Spanish (Spa) (41% foreign workers), and that the most common crop is tomato (Tom). These results agree with those of earlier sociodemographic studies undertaken by the Cabrera-Sánchez and Uclés-Aguilera (2011). This indicates that the sample was representative, even though no greenhouses growing melons, watermelons, beans or aubergines were included (a reflection of their scant importance compared to tomatoes).

Cluster A of Fig. 4 contains no worker qualitative variables (in red throughout Fig. 4), indicating an absence of correspondence between these and the variables Aut-L, Dem-L, CM-L, Rel-L, Rec-L, Com-L, and Con-L (in black throughout Fig. 4; see Table 5). It should be noted that the variables in this cluster are all associated with low risk, except for Dem-H (see Table 5). Just 4.52% of the workers (Table 7) were affected by this problem, the majority being able to meet the demands of their work. This agrees with other data of Callejón-Ferre et al. (2009b, 2011b).

Cluster B in Fig. 4 includes three different nationality categories (Afr, His, and Spa) which together form a practically equilateral triangle (in green in Fig. 4) that engulfs Mob-H, Rec-M, Hea-M, Rhy-M, Rel-M, Sup-M, Com-M, Con-M, Aut-M, and CM-M (see Table 5). This is important, since African (28.71%), Hispanic-American (3.55%), and Spanish (58.39%) workers together represent 90.65%of the workforce evaluated (Table 7). Mob-H appears to exert the strongest effect on Hispanic-American (His) workers in courgette (Cou) greenhouses. Outside the cluster B triangle, the variables Hea-H and Mob-M are associated with Spa (see Table 5). This may explain why Spanish workers declare poorer health than the foreign workers (His and Afr), who might be more accustomed to difficult working conditions in their home countries where no national health service exists. This conjecture agrees with Cross et al. (2009), who attribute this fact more to social characteristics of the workers than to company benefits.

Similarly, variables F, S2, Pla, and T1 (in red; see Table 5) are associated with Emo-M and Dem-L (see Table 5). The association of

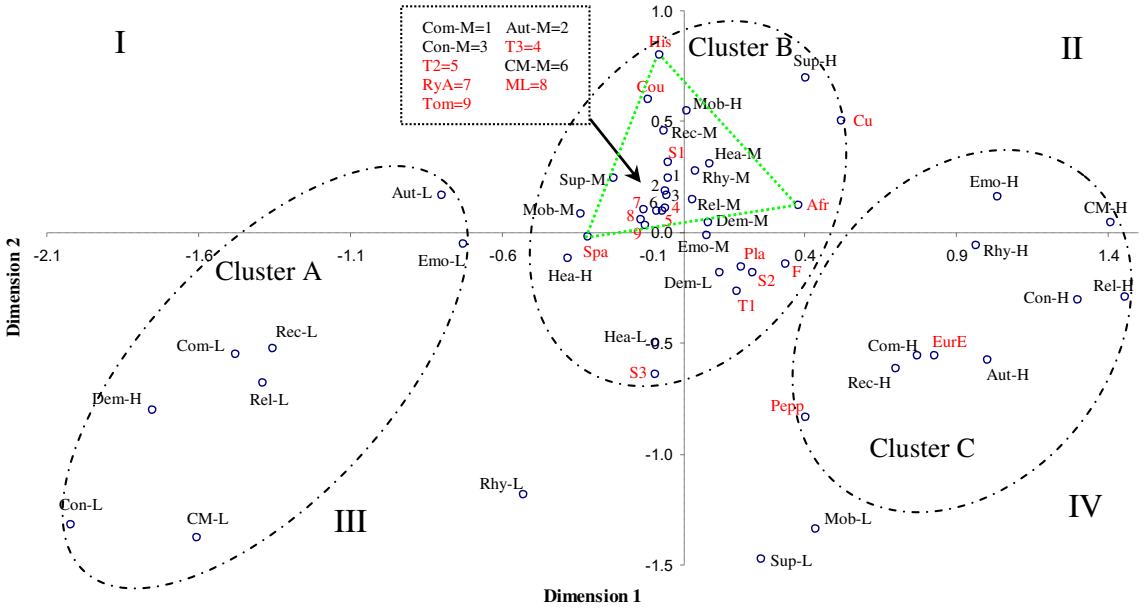

Fig. 4. Relationship between all the categories of all the variables studied.

the sexes with Dem-L differs; the perception of complexity would therefore appear to be different for men and women and less of a problem for the latter, this conclusion coinciding with that of Thelin (1998). The young worker group (T1) was more associated with Dem-L than were age groups T2 and T3, in agreement with Strasser (2009).

Finally, cluster C shows EurE to be associated with Com-H, Rec-H, and Aut-H (see Table 5), and much more weakly to Emo-H, CM-H, Rel-H, Rhy-H, and Con-H (see Table 5). Apart from language problems, this may be because Eastern European workers may have an academic standing above that required for this kind of work.

It is a priority to know the percentage of workers at high risk of problems examined by the MPF method, and to provide immediate help to remedy the situation (Ruíz and Idoate, 2005). For example, 48.71% of the workers were subjected to high risk with respect to Mobbing (Mob) (investigated via questions 6 and 13 of the questionnaire) (Table 7). Fig. 4 (cluster B-green triangle) shows that a high Mobbing risk (Mob-H) is more strongly associated with Hispanic-American persons (3.55% His, see Table 7) and Africans (28.71% Afr, see Table 7) who work in greenhouses of 2 ha (56,77% S1, see Table 7). In these greenhouses (S1), the labour is mainly family (40%) and is strongly committed to the family business (Céspedes-López et al., 2009), facilitating the hiring of seasonal workers (3–6 months per year). This, together with the different culture of the Africans employed (who are the majority among immigrant workers) and together with sensations of low self-esteem, the lack of the family group, being faced with new ways of life (Hovey and Magana, 2002), and economic problems could explain this situation (Ehlers et al., 1993). In addition, some 30.65% and 23.87% of workers were at high risk with respect to Recognition (Rec) (as determined by question 8) and Autonomy (Aut; question 5), respectively. Fig. 4 (cluster C) the risk situation of high Recog-nition (Rec-H) and high Autonomy (Aut-H) is more closely associ-ated with persons from Eastern Europe (9.35% EurE, see Table 7) who work in greenhouses of more than 2 but less than 4 ha (21.29%S2, see Table 7). In this case, the percentage of fixed salaried labour (40%) is far higher than family labour (25%) and those with contracts of 9–12 months more stable (Céspedes-López et al., 2009). This reflects that many farmers fail to recognize the good work of their employees and limit their autonomy. This is important, since, as indicated by Gyekye (2005), recognition is positively associated with worker satisfaction, which in turn has an impact on employee productivity.

Table 7 also shows that if the individuals at high risk and medium risk are taken together, then 70% of the workers questioned need solutions in the short to middle term. Though the Spanish risk-prevention system for work (BOE, 1995) guarantees free state health care, yearly medical examinations and risk-prevention education should be reviewed with respect to the psychosocial risks in greenhouse agriculture, creating new prevention programmes or networks (Vega et al., 1985; Hovey and Magana, 2002; Hoglund, 1990) capable of assisting workers, especially immigrants to help them face the possible family and/or cultural problems of adaptation to the new living conditions. In these programmes, the agro-businessmen should actively participate in order to learn to value the work of the employees and avoid daily losses of work, i.e. to lower the labour cost of the company (Ehlers et al., 1993).

Specific measures that could form part of the these prevention programmes could include salary bonuses (Gay-Puyal, 2006), adjusting the starting and ending times of the work day to allow a better family life (Mauno et al., 2006; Daalen et al., 2009), providing rest places in the work environment (Martín-Ochotorena, 2007), rotating workers so that they perform varied tasks (Gallis, 2006), establishing an extra break period (González-Gutiérrez et al., 2005), providing training courses, having social days, or starting an activity in which owners and workers come together. Given the current economic crisis, these steps would doubtless be hard to take, but the reward would be improved worker productivity.

The present results reveal that while the MPF method can gather information quickly, the final discrimination between variables is not so good. Other methods that include more items in their questionnaires (Table 1), and which therefore provide more or higher-quality information, may provide a more reliable picture of the psychosocial risks faced by workers in Almería's greenhouses.

Finally, the comparison of the present study with future research on the physical load in the sector of greenhouse cultivation is needed (Callejón-Ferre et al., 2009b, 2011b) in order to test the relationship of psychosocial risks with skeletal–muscle

disorders (Fathallah, 2010; Bernard et al., 2011; Chapman et al., 2004; Habib and Fathallah, 2012; Abrahao et al., 2012).

5. Conclusion

The present results, found using the MPF method, show that Almería's greenhouses do not provide the best of psychosocial working environments, and that short- to middle-term actions are needed to help solve these problems. It is necessary for the government of Spain to recognize the precariousness of psychosocial wellbeing of greenhouse farm work. For this, new prevention programmes that improve current Spanish legislation are needed to optimize the psychosocial conditions of agricultural workers in greenhouses. Similarly, the owners should participate in these programmes. Measures such as salary bonuses, owner–worker social days, training, and better timetables that facilitate family life could help. Such steps would not only improve workers' psychosocial health but would also boost their productivity. These findings need to be verified using a methodology that includes more study items.

Acknowledgements

To Emilio Ruíz and Víctor Idoate.

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