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FIREFIGHTING BOOTS: A COMPARATIVE ANALYSIS OF THE PERCEPTIONS OF THE ELEMENTS OF TWO PORTUGUESE FIRE BRIGADES

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Abstract

Personal protective equipment is extremely important for protection against the various occupational risks to which firefighters are exposed. The comfort of such equipment is directly related to the level of protection and operational performance. Aiming to evaluate and propose improvements to the personal protective equipment used by Portuguese firefighters, a study is being developed by the Center for Textile Science and Technology, University of Minho. As part of the data collection protocol, a questionnaire and an interview are applied to the participants, to obtain their opinions and reports of experiences regarding the protective equipment used. The objective of this article is to present and compare the perceptions of the members of two Portuguese fire departments in relation to the protective boots used in fighting urban and industrial fires. It can be concluded that, although the participants of both corporations are satisfied with the protective boots, there are opportunities for improvements regarding comfort, mainly in relation to weight and the numbering system.

Keywords: Personal Protective Equipment. Urban and Industrial Fires. Comfort.

1. INTRODUCTION

Personal protective equipment is considered as the worker's third line of defense. Directive 89/656/EEC of the European Parliament stresses that, as a general rule, personal protective equipment (PPE) should be used only when there is no capacity to apply preventive measures, methods or processes inherent to the organization of work or by technical means of collective protection. However, in many work contexts, they are the only resource available to protect workers against various risks to which they are exposed. The occupation of firefighters is one of these cases.

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Veiga (2019) points out that all the activities of a firefighter involve risks that cannot be eliminated. PPE is intended to protect firefighters against physical, biological and chemical risks present in the various missions, directly dependent on the environment where they are carried out, having very different characteristics. Therefore, PPE for the protection of firefighters varies according to the type of mission and the environments in which they are performed.

The role of fire brigades for societies is absolutely fundamental, being the first to be called to respond to a variety of situations. In Portugal, the mission of fire brigades involves, above all: the prevention and fighting of fires; the rescue of the population in the event of fires, floods, landslides, collisions and, in general, in all accidents, catastrophes or calamities; the rescue of shipwrecked people and underwater searches; the rescue and transport of injured and sick people, including pre-hospital emergency, within the scope of the integrated medical emergency system (Decree-Law No. 247/2007).

Within this framework, for the fight against urban and industrial fires (also called structural fires), it is mandatory to wear clothing (a set of jacket and pants or overalls to protect the torso and limbs) and other protective equipment, such as gloves to protect the hands and wrists; boots, for the protection of the feet, ankles and legs; a helmet with a visor to protect the neck, face and head (Castro and Abrantes, 2005).

1.1. Urban and industrial firefighting boots

The risks to the feet, ankles and legs in firefighting and other missions include, mainly: exposure to extreme temperatures of equipment, materials and chemicals; exposure to sharp, perforating or abrasive elements; the handling or manipulation of heavy objects; contact with vehicles or moving objects; exposure to hot, wet or slippery floors; and exposure to electric current or electrostatic charge.

For urban and industrial firefighting and for other rescue activities, such as flooding and rescue, boots must be used, in accordance with the normative requirements set out in the European standard EN 15090:2012. They must be made of leather, in black, and may or may not have laces and closures. They must also contain protective toe caps and anti-perforation insoles, be resistant to oily substances and slipping, and have heat-insulating properties. Depending on the type of mission, they must have antistatic and/or electrical insulation properties. Figure 1 illustrates two models of urban and industrial firefighting boots, available in the Portuguese market.

Figure 1. Urban and industrial firefighting boots (Guerra, 2005)

1.2. Comfort and level of satisfaction of firefighters with firefighting PPE

The comfort offered by PPE has been increasingly discussed, noting its direct relationship with acceptance and use (OSHA, 2004). PPE that is not compatible with the anthropometric characteristics of workers ends up being little or not used.

The use of firefighting PPE requires an additional effort from the firefighter due to the weight, the difficulty of movement and, in some cases, the lack of visibility (Guerra, 2005). A correct adjustment of PPE is critical not only for protection, but also for the operational performance of firefighters (Park and Hahn, 2014).

Experimental studies, such as the one by Park et al. (2015a) point to restrictions in lower body mobility due to the use of PPE, especially the impact of boots on the range of motion in the ankles and in the distal region of the soles of the feet. In another study, Park et al. (2015b) evaluated the impact of the use of PPE on gait patterns, compared different materials in which firefighting boots are made, and suggested the relevance of investigating the effect of boot fit on locomotion and perceived comfort.

Studies that seek to obtain the perceptions of firefighters in relation to the use of their PPE have pointed out complaints, especially in relation to comfort. Boorady et al. (2013) applied focus group techniques and questionnaires with North American firefighters. Participants mentioned excessive boot shaft height, making it difficult to move and put on boots (Boorady et al., 2013). Also, in the United States and using similar techniques, Park et al. (2014) obtained responses from 54 firefighters, who evaluated support, lining, and flexibility as the

worst characteristics of boots. Blisters on the feet and legs were also related as a consequence of bulky rubber boots, as well as the preference for leather boots (Park et al., 2014). An international study, published by Lee et al. (2015), found that different materials are preferentially used in boots in numerous countries, concluding that, in general, leather boots are preferred. Despite being heavier, stiffer, and with a worse fit, rubber boots are more appropriate for wet areas and less slippery in cold temperatures, such as during winter. Another study, conducted by Nunes and Fontana (2012), with Brazilian firefighters, mentions the appearance of calluses resulting from boots and the difficulty in relation to the numbering of available boots.

In Portugal, the report "User requirements – fire protection", published by the mobilizing project PPS4 2011/2012, highlighted the main problems in firefighting equipment according to the Portuguese firefighters, based on the application of an online survey. Of the 1,018 firefighters who responded to the questionnaire, about 90% of them pointed out, among the characteristics considered "very important" in structural firefighting equipment, "ease of movement" and "functionality". These two characteristics are second only to the characteristic "thermal insulation", considered "very important" by approximately 95% of the respondents. General comfort was evaluated as the fourth "very important" characteristic, having been pointed out by more than 85% of the respondents.

Still on the satisfaction of Portuguese firefighters with PPE, more recently, through a questionnaire applied to 240 firefighters from 15 corporations in the district of Bragança, Veiga (2019) concluded that the weight of the boots affects the performance of professionals, and the impact is considered lower only when compared to the open-circuit isolating breathing apparatus (ARICA).

1.3. Anthropometric Study of Portuguese Firefighters

Since 2017, a consortium of 12 universities in the United States has been developing an anthropometric study called *Size FF – Size Firefighter*, whose main objective is to improve the current PPE used by North American firefighters. In 2018, in a partnership with this consortium, the Center for Textile Science and Technology (2C2T) of the University of Minho took the study to Portugal, and the Size *FF Portugal study – Anthropometric Study of Portuguese Firefighters was created*. It provides for the collection of data in fire departments in all districts of the country. In an initial phase, data were collected from about 100 firefighters from two different corporations.

The objective of this article is to present the comparative analysis of the perceptions of the Portuguese firefighters who are members of these two corporations with regard to the level of satisfaction, experiences of use and points of improvement related to fire boots for fighting urban and industrial fires.

2. MATERIALS AND METHODS

The protocol established for the development of the *Size FF Portugal study* provides for the collection of anthropometric data through direct and indirect measurements, the latter being obtained by three-dimensional digitization. In addition, it includes the application of a questionnaire, aiming to collect the perceptions of the participants in order to identify specific needs, assess the level of satisfaction and highlight points of improvement in relation to the PPE used[1].

In addition, the questionnaire also aims to collect sociodemographic information from the participants and the type of missions in which they operate, obtain information about the fire department they serve, as well as understand how the purchase and choice of PPE takes place.

The questionnaire prepared by the North American group was translated from English to Portuguese, trying to keep the questions as reliable as possible with the original. However, some issues have been adapted, such as those that include the identification of the brands and models of the equipment, in order to adapt to what is offered in the Portuguese market.

The questionnaire, composed of approximately 80 questions, is divided into 5 parts. The first includes questions for the sociodemographic characterization of the participants (gender, age, ethnicity, type of bond – professional or volunteer firefighter, length of experience as a firefighter and types of missions in which they work) and the fire department in which they serve (municipality and district, number of inhabitants, type of environment protected by the fire department). The second, third and fifth parts include specific questions about the jacket, trousers and personal protective gloves, respectively. The fourth part, dedicated to protective boots, includes 16 questions, divided into 4 topics: brand identification, model, size and gender

[1] As PPE varies according to the types of missions carried out, it was decided to concentrate on equipment used in urban and industrial firefighting. During data collection, participants were verbally instructed to answer the questionnaire, taking into account this model. The choice was based on the types of missions and frequency of use of each type of equipment and had, as a reference, the number of types of services provided by fire departments, according to the Portuguese National Institute of Statistics, in which the number of firefighting other fires is approximately 6 times higher than fighting fires in forest stands (INE, 2018). In addition, other missions that do not involve firefighting, but in which firefighters must use urban firefighting PPE, in whole or in part, such as extrications, and which are statistically counted as "other services" (INE, 2018) should be added to these data.

(3 questions); purchase and choice procedure (4 questions); modifications made during use (1 question); and difficulties in adjusting specific regions of the boots (8 questions).

The QualtricsXM *online platform* was used to design and administer the questionnaire. A semi-structured interview was conducted in order to clarify the participants' doubts, when necessary, as well as to include other questions that were pertinent throughout the study and that were not initially included in the original questionnaire of the North American study.

The questionnaires/interviews were applied individually, conducted by the researcher in charge. The interviews were audio-recorded and later transcribed for analysis. The answers, stored on the *QualtricsXM* platform, were later extracted for statistical analysis.

3. RESULTS AND DISCUSSION

As mentioned, the results presented below highlight personal protective boots for urban and industrial firefighting. Initially, the sociodemographic data of the participants are presented and a brief characterization of the fire brigades is made. Then, the participants' perceptions regarding the fit in specific parts of the boots are presented. In the final part, other relevant aspects are also discussed, spontaneously reported by the participants or induced by the semi-structured interview.

3.1. Sociodemographic Information

The first fire department in which the data was collected is a volunteer fire department, which protects a municipality with approximately 160 thousand inhabitants. In its staff, there are about 145 firefighters, around 45 of whom are hired by the corporation (called salaried) and who work 8 hours a day. Salaried firefighters must also work on a voluntary basis on weekend shifts and night shifts during the week. The other elements of the corporation (approximately 100 elements) work exclusively on a voluntary basis, fulfilling a workload of 8 hours per week on night shifts on weekdays and a workload of 12 hours on weekends, depending on the schedule. From here, this fire department will be designated as CB.01.V.

The second fire brigade where the data collection took place is of the professional type (sapper,) composed exclusively of professional firefighters. Its 266 elements protect a municipality with about 240 thousand inhabitants. They are divided into 5 teams, which work continuously, in rotating shifts of 12 hours a day. From here, this fire department will be designated as CB.02.P.

The main types of missions of the two fire departments include extrications, pre-hospital emergencies, urban and industrial firefighting, and forest firefighting. However, fighting forest fires is rarely the competence of the professional fire department, as it is more directed to occurrences in an urban environment.

Data collection took place at the facilities of both corporations, and all its elements were invited to collaborate with the study. In the first corporation (CB.01.V), 49 firefighters participated, of which 13 were female and 36 were male. In the second corporation (CB.02.P), there were 32 firefighters, all male, because it does not have women in its staff. Table 2 shows the mean ages, years of experience and type of employment of the participants.

Table 2. Sociodemographic data of the firefighters participating in the study

Fire Department	**CB.01.V**	**CB.02.P**
Number of participants	49	32
Age [years]		
Mean (SD)	37,49 (10,23)	33,44 (8,48)
Min-Max	21 – 62	23 – 51
Length of experience as a firefighter [years]		
Mean (SD)	15,35 (11,28)	10,00 (7,69)
Min-Max	0,17 – 38	1 – 23
Bond Type [n (%)]		
Professional	-	32 (100%)
Salaried and volunteer	31 (63,27%)	-
Voluntary	15 (30,61%)	-
Trainee	2 (4,08%)	-
*Other**	1 (2,04%)	
Distribution by sex [n (%)]		
Male	36 (73,47%)	32 (100%)
Female	13 (26,53%)	-

*Second Commander

3.2. Perceptions on the fit of urban firefighting boots

To assess the comfort of the specific parts of the boots – straps, upper edge and laces region, calf and shin, toecap, instep, plantar arch, sole of the foot and heel –, the questionnaire contains an illustrative figure and then asks the same question about each one:

"Please explain the difficulty of fitting the [specific part] of your personal protective boots."

For each of the questions, there are closed-answer alternatives, according to the evaluated part of the boots (for example, "too loose", "too tight"...), a closed alternative "I don't have any difficulty" and an open one "another (please explain)".

The results of the responses of the members of the two corporations are presented in Tables 3 and 4 and briefly described below.

Straps: they make it easier to put on the boots and this is the part where the differences between the two fire brigades are most relevant. While the majority of participants (93.88%, n=46) of CB.01.V stated that they had no difficulty with the straps, 40.63% (n=13) of the participants of CB.02.P answered the "other" alternative, explaining that they did not use the straps to put them on or that the boots did not have straps. Regarding the question, we assumed the possibility of a distortion in the application of the questionnaire, since, while in the first corporation no participant mentioned not using the handles, in the second, as one of the first participants reported not using the handles, the question began to be informally asked to the participants. This aspect highlights the need to reformulate the question, so that it can be clarified whether the absence of difficulties is related to the fact that the straps are not even used to put on the boots. Even so, some participants emphasized the importance of the handles, as verbalized by a male professional firefighter from CB.02.P, when asked if they use and if the handles are good: "I use... it's great... it's the best thing... if they take that away from me, I don't think I can put on those boots."

Calf and shin: regarding this part of the boots, CB.01.V participants reported more difficulties than CB.02.P participants. Still in relation to the calf, 14.29% (n=7) of the CB.01.V and 9.38% (n=3) of the CB.02.P answered "other", detailing that they are a "little" or a "bit" or a "little" loose. The analysis of the answers found the difficulty in interpreting the adjective "very", used in the answer alternatives ("very tight", "very loose", "very long", "very short"...), translated directly from the questionnaire in English (*too tight*, *too loose*, *too long*, *too short*...). Such difficulty was also verified in the questions of other specific parts of the boots.

Toecap: part of the boots that gathers the most similarities in the answers of the participants of the two corporations. Most reported not having any difficulties (87.76%, n=43 in the CB.01.V and 87.50%, n=28 in the CB.02.P). Three participants (6.12%) from CB.01.V and 1 participant (3.12%) from CB.02.P answered the question as "other". Among the participants of CB.01.V, one explained that he found the toecap "a bit loose", another mentioned that the difficulty is the size of the boots and the lack of standardization of the numbering in different types of shoes and manufacturers. Other participants chose to answer "another" and

said: "with two pairs of socks it looks great," said a volunteer firefighter from CB.01.V, and "I start to feel it in my fingers if I walk a long time with the boots," said a professional firefighter from CB.02. Q.

Table 3. Answers from the participants of the two fire brigades to the parts: handles, calf and shin, toecap.

	Long		Short		Loose		Narrow		No difficulty		Other	
	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P
Regarding the straps												
n	0	0	1	1	0	0	1	0	46	18	1	13
%	0	0	2,04	3,13	0	0	2,04	0	93,88	56,25	2,04	40,63
Calf and shin												
n	1	0	0	0	2	3	2	0	37	26	7	3
%	2,04	0	0	0	4,08	9,38	4,08	0	75,51	81,25	14,29	9,38
Toe cap												
n	-	-	0	0	3	2	0	1	43	28	3	1
%	-	-	0	0	6,12	6,25	0	3,13	87,76	87,5	6,12	3,12

Upper edge: most participants from both fire brigades (71.43%, n=35 for CB.01.V and 71.88%, n=23 for CB.02.P) answered that they had no difficulty with the upper edge of the boots. However, 9 participants of CB.01.V answered the question as "other". Of these, among the firefighters, 2 said that the boots are a "bit wide", 1 said that it is a "bit tight" and another that the boots hurt the skin, and therefore she wears a high sock to above the upper edge of the boots. The responses of the male participants from the same corporation were similar, with 2 of them mentioning that the edges were a bit loose and 3 mentioned that they hurt the skin. The "other" answers of the 3 participants of CB.02.P are quite similar. The firefighters' verbalizations illustrate their perceptions:

> Now it does, because they are old, but while they are young they have that sponge that is comfortable. Mine already shows the sponge... it is already starting to bother you. I put on one of those player-type socks, which is no longer there rubbing the skin with the boot, it already has the sock there so that it is not there rubbing, burning... (male, volunteer, CB.01.V).
>
> There's one thing there... is... If a person does not have a high sock, the part of the edge, when sweating, with the suit, begins to put red on the leg muscle, begins to rub against us. The pants are on the outside, they start to rub against the leg muscle, then even inflame, if we don't have a sock that protects us (male, salaried and volunteer, CB.01.V).

> Is... that was the part I was [sic] talking about... She's a bit loose, and there's the friction of twins there... it's also more because of that that if you have your socks high, you don't notice it so much... Sometimes, if you're wearing normal socks, you go for a bit of a run... When I go with the small socks, I already know that... [laughs] if it's going to last a while... that goes to pass... on the top of the boot (men's, professional, CB.02.P).

Instep: the responses of CB.02.P participants were more varied than CB.01 participants. V in relation to the instep. For 4 participants (12.5%), the boots are too tight in this part, for 1 participant (3.125%) it is too loose and for 1 (3.125%) participant it is too narrow. Among the 2 participants of this same fire department who answered the question as "other", one said "they are a little tight in the ankle area, in the joint" and another cited the strategy he used when he received the boots:

> When they were young, it was the situation because I... I used it only on the night shift... Because, in the night shift, we have the facility that when there is work, there is work, and when there is no work we can go to rest, right? [laughs] And then we took off our boots... and, during the day, I had to walk all day with them... and I started to use it little by little, until I molded it to my body... to the foot (male, professional, CB.02.P).

***Sole of the foot*:** participants from both fire brigades have different perceptions of the sole of the foot. While in CB.01.V the answers were quite varied (8.16%, n=4 answered "very hard"; 2.04%, n=1 answered "very soft"; 4.08%, n=2 answered "very wide"), in CB.02.P, 37.50% (n=12) of the participants answered as being "very hard". Also for CB.01.V, among those who answered "other" (8.16%, n=4), 1 participant stated that they are "a little wide", another that they are "slightly wide, wears two pairs of socks" and a firefighter stated that they are "a bit wide". Another participant, who also opted for this answer, suggested that "it would be interesting to have insoles with another type of material that is more resistant to perspiration". In relation to the question, it is worth highlighting the fact that the feet were mentioned by the respondents of the PPS4 Project (2011/2012) as the second area of the body – the first is the face – where heat is felt more intensely, being considered very important by more than 35% of the participants. Similar results in relation to this aspect were obtained by Veiga (2019).

Plantar arch: pointed out as very loose, the plantar arch part of the insoles does not offer good internal support, which was considered by 14.29% (n=7) of the participants in CB.01.V and 9.38% (n= 3) of the participants in CB.02. Q. On the other hand, 1 participant (2.04%) in CB.01.V

considered too tight (it has excessive internal support in height). However, most participants from both fire departments reported that they did not have any difficulty in this part of the boots (81.63%, n= 40 in CB.01.V and 90.63%, n= 29 in CB.02.P). From CB.01.V, 1 participant (2.04%) answered "other", stating that the boot "does not follow the curvature of the sole of the foot" (male, salaried and voluntary, CB.01.V).

Table 3. Responses from participants from both fire departments to the parts: upper border, instep, sole of the foot, plantar arch, heels.

	Tight/very supportive (arch)/hard (sole)		Loose/unsupported (arch)/too soft (sole)		Narrow		Wide (chest/plant)/poor fit to pants (top hem)		No difficulties		Other	
	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P	CB.01.V	CB.02.P
Top edge												
n	3	0	2	6	-	-	0	0	35	23	9	3
%	6.12	0	4.08	18.75	-	-	0	0	71.43	71.88	18.37	9.38
Instep												
n	0	4	2	1	0	1	1	0	46	24	0	2
%	0	12.5	4.08	3.13	0	3.13	2.04	0	93.88	75.00	0	6.25
Plant of the foot												
n	4	12	1	0	0	1	2	0	38	18	4	1
%	8.16	37.5	2,04	0	0	3,13	4,08	0	77,55	56,25	8,16	3,13
plantar arch												
n	1	0	7	3	-	-	-	-	40	29	1	0
%	2.04	0	14.3	9.38	-	-	-	-	81.63	90.63	2.04	0
To heel												
n	0	3	6	3	-	-	-	-	41	21	2	5
%	0	9.38	12.2	9.38	-	-	-	-	83.68	65.62	4.08	15.63

Heel: for CB.02.P participants, the heel part of the boots was considered to have a worse fit than for CB.01.V participants. For 83.68% (n=41) of the participants in the CB.01.V, the heel does not present any difficulty. And a smaller percentage (65.62%, n=21) of the participants in the CB.02.P answered the same. From the CB.02.P, 3 participants (9.38%) answered "very tight", another 3 (9.38%) answered "very loose" and 5 (15.63%) answered "other", with heel stiffness being pointed out by the majority, especially when new, as illustrated in the following statements:

> They make a lot of bubbles... (male, professional, CB.02.P).
>
> At first, it always hurts, until I adapt. Today, I no longer come with red feet... (male, professional, CB.02.P).
>
> Hard... after a few minutes he starts to grind his heel... (male, professional, CB.02.P).

> It lasts, and there is a part that causes discomfort. I've already made blisters on my heels... with water and heat, a minimum of friction is enough (male, professional, CB.02.P).

The 2 participants (4.08%) of CB.01.V, who also answered "other", show similar opinions:

> On the heel, if I go with a thin sock, I have a lot of space there, it will rub... if it is with the foot full, it does not rub and there is not so much friction (male, voluntary, CB.01.V).
>
> Is... Hurt. After a long time, it starts to hurt. After long use, as they say here, it still has no bed, that is, it is not softened [laughs] (male, salaried and voluntary, CB.01.V).

3.3. Other relevant aspects: weight and size of the boots

As factors that compromise the comfort of firefighters in carrying out their activities, the weight and volume of firefighting PPE are considered. Although it was not part of the original questionnaire applied to the two fire brigades, the weight of the boots was commented on by several participants, which is why it was included in the interview script. In relation to this aspect, some considerations are illustrative:

> It's [sic] all great! The only thing is that many hours with them on is that they start to get heavy... (male, salaried and voluntary, CB.01.V).
>
> That is very heavy... The worst I think is the weight of the boots because of the steel toe cap. After some time, it begins to weigh (female, volunteer, CB.01.V).
>
> Oh yes, they're a bit heavy, aren't they? But I think that in terms of weight it shouldn't be much different from the others I had before, it should be more or less the same. The equipment itself is heavy, isn't it? So with everything, with ARICA, all equipped, facepiece... There it is, the more, how shall I say, the more protection a person has, the more difficult it is to work, you see? (male, professional, CB.02.P).

Such perceptions confirm the results of other studies. According to Veiga (2019), among the characteristics that should be changed in urban firefighting boots, weight is considered the most relevant. The PPS4 Partnership report (2011/2012) also points out the excessive weight of the boots, in addition to limited thermal insulation and impermeability, presenting, as described, "low ergonomic index".

However, it is necessary to consider that, generally, boots are used for short periods of time. Urban and industrial firefighting missions are usually fast, especially when compared to those fighting forest fires. Many CB.01.V participants reported that in the case of wildfire boots,

the impact of weight is even more relevant to discomfort. It should be noted that it is during training and training that urban fire boots are used for a longer time.

Another aspect perceived during the application of the questionnaire was the use of two pairs of socks or taller socks, as in the words of some participants, "soccer player style". The strategy was reported by several firefighters, especially among those of CB.01.V, to avoid friction, especially on the calves and heels. It was possible to identify that this strategy is also used by many participants to adjust the size of the boots, either because they do not use the size that would be indicated (because the number is not available in the fire department, in the case of CB.01.V.) or because they choose a larger size, to make it easier to put on and take off the boots (report by several participants), which demonstrates the need for improvement in the manufacturers' numbering system. It is also important that the numbering system includes the ankle and calf regions, which has a great impact on the comfort of the boots.

4. CONCLUSIONS

This article compared the perceptions of the elements of two Portuguese fire brigades in relation to boots for fighting urban and industrial fires. In general, the participants were satisfied with the boots. When comparing the perceptions in relation to specific parts of the boots, the elements of the volunteer fire department answered that they had less difficulty in 5 of the parts evaluated – handles, toecap, instep, sole of the foot and heel. The other 3 parts evaluated – upper edge, calf and plantar arch – present less difficulty for the participants of the professional fire department.

It is concluded that there are points of improvement regarding the comfort and fit of the urban fire boots available in the Portuguese market. The weight of the boots was spontaneously mentioned by several participants from both corporations. In addition, there was a difficulty in relation to the manufactured sizes, which were not always adjusted or compatible with the anthropometric measurements of the feet, ankles and calves, directly impairing the comfort of the boots. The strategy of using two pairs of socks or taller socks portrays this need.

Such aspects demonstrate the relevance of the Size FF Portugal study, which aims, among other objectives, to develop numbering systems that better contemplate the anthropometric dimensions of Portuguese firefighters. In this way, PPE will definitely be more adapted, providing comfort, which, ultimately, contributes to the performance of professionals who are so dear to society.

At this stage of the study, it was possible to obtain relevant information and greater familiarity with the reality of firefighters in Portugal. In addition, questions not included in the original questionnaire were included, and the language was revised in order to improve the understanding of the questionnaire.

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