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Working conditions at hospital food service and the development of venous disease of lower limbs

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The present study assesses some factors that may influence the development of lower limb venous disease in workers of a hospital food service unit. An Ergonomic analysis of work was carried out at a hospital located in the south of Brazil. As for data collection, the following were used: interviews and body mass index assessment; specific clinical examination to diagnose venous disease, water displacement volumetry of the lower limbs. The activities performed at the workplace were followed by direct observation with image registration, use of pedometers, stopwatches, decibel meter, and digital thermo-hygrometer. It was observed different degrees of venous disease in 78% of the cases investigated. The volumetric variation of the lower limbs was 5.13%, showing the presence of edema. Working in hospital food service is associated with circulatory disorders of lower limbs, such as edema and venous disease. The following risk factors were identified: standing activities at work during a long period of time, high temperature, and humidity and carrying heavy weights.

Keywords: hospital kitchen; ergonomics; venous insufficiency; occupational health

Introduction

Venous disease is an important public health problem responsible for a significant morbidity, with socioeconomic consequences that may lead to missing work and hospitalizations, thereby indirectly affecting production quality and consequently decreasing operational efficiency. Contrary to many other chronic diseases, patients and health professionals often demonstrate little concern for the presence and severity of venous diseases (Tabares & Sánchez-Coll 1998; McCulloch 2002; França & Tavares 2003; Allaert et al. 2005; Tagarro-Villalba et al. 2005; Chiesa et al. 2007; Moura et al. 2010).

The relationship between work conditions and venous disease has been described by many authors in studies done with workers of the industry and service sectors evidencing some risk factors (Abramson et al. 1981; Maffei et al. 1986; Brand et al. 1988; Krijnen et al. 1997c; Sudol-Szopinska et al. 2007). Among the main risk factors listed, those that are associated with the work done in the food production sector are as follows: working in the standing position whether static or dynamic, the high humidity

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and temperature of the environment, carrying excess weight and using tight clothing. Overweight and obesity which are common among workers of the food production sector (Matos & Proença 2003; Boclin & Blank 2006) also seem to be a risk factor, as well as the higher incidence of venous diseases among women. This is a relevant aspect since most of the workers in this sector are females.

The traditional food service process is characterized by intensive use of labor. A particularity of food services is their great dependence on the performance of their labor force and sometimes this is one of their main problems. With working conditions that are not always favorable, this sector is not attractive for workers, which is evidenced by its high employee turnover and absences. Requiring high productivity in a limited amount of time and in environmental conditions, equipment and processes that are frequently inadequate can result, among others, in unhappiness, discomfort, lack of attention, excessive fatigue, loss of productivity, work accidents and health problems (Proença 2000).

The complaints of the workers of this sector regarding venous disease are usually described as a sensation of weight and pain, edema, night cramps, and tired legs. According to reports, these problems are usually worse during the day, especially after a long time standing up. The standing position, common in this sector, requires the static work of the muscles involved in the maintenance of this position, leading to muscle fatigue (Kroemer & Grandjean 2001). Furthermore, the capillaries are strangled, impairing the blood and lymphatic circulation.

Although several epidemiological comparisons between different professions have been made, the real nature of the work, the adopted postures, the gestures, the polyvalence of the positions, and their evolution in time have rarely been described to this date. This is why the ergonomic approach to this subject is justified, through which it could be established some important points concerning the relationship between venous disease and work. Thus, the objective of this study was to assess which factors may influence the onset or aggravation of venous diseases of the lower limbs in workers of a hospital food service unit.

Methods

A qualitative study was developed in the production sector of a reference hospital food service located in the south of Brazil, which produces 1580 meals per day. The methodology adopted was the Ergonomic Work Analysis (EWA) and its stages: analysis of the demand, analysis of the request, analysis of the activities, diagnosis and ergonomic recommendations, which provides an understanding of how the operator builds the problem, as well as identifies any obstacles in the path of this activity, enabling the obstacles to be removed through ergonomic actions (Wisner 1995).

Data were collected from all the female workers with at least 1 year working in the sector. We excluded all cases that used compression stockings, phlebotonic, anti-hypertensive, and diuretic drugs, or those who had history of deep venous obstruction, peripheral arterial disease, lymphedema, suspected or confirmed pregnancy, and any history of systemic diseases such as angina, congestive heart failure, myocardial infarction, asthma, chronic obstructive pulmonary disease, hepatic or renal insufficiency, and malignancy. To avoid bias based on gender, we chose to include only women in the sample, although we have found this recommendation in only one study (Boitel et al. 1982).

The instruments used included interviews based on questionnaires developed for venous insufficiency to assess the complaints presented by the individuals such as heaviness, aching and cramps, and their family history for the disease (Sobaszek et al. 1996;

Krijnen et al. 1997a; Lozano et al. 2001; Ziegler et al. 2003; Kahn et al. 2004; Tagarro-Villalba et al. 2005; Sudol-Szopinska et al. 2007). In order to avoid interviewer's subjective interpretation, the speech was focused during the interviews, and the responses were categorized (Gómez 1999), especially those about the work performed and the complaints related to it.

Other data were also collected such as weight (digital scale with a capacity of 150 kg and sensitivity of 100 g) and height (vertical stadiometer of 220 cm) to calculate the body mass index, resulting in the nutritional diagnosis recommended by the WHO classification (WHO 1995). Two specialists in angiology and vascular surgery were responsible for the physical examination to diagnose venous disease based on the CEAP classification (*clinical, etiological, anatomical, pathophysiological*), largely used in epidemiological studies (Porter & Moneta 1995; Nicolaides 1997; Caggiati et al. 2005; Eklöf et al. 2009). The diagnosis of venous disease was based only on clinical findings and was not confirmed by non invasive or invasive techniques.

In order to observe the volume variations of the lower limbs, each worker was submitted to water displacement volumetry at the beginning and end of each day work evaluated, according to some protocols (Stranden 1981; Brijker et al. 2000; Perrin & Guex 2000; Moholkar & Fenelon 2001; Lund-Johansen et al. 2003; Post et al. 2003; Tsang et al. 2003; Dodds et al. 2004; Belczak et al. 2004). For this end, an 8 mm acrylic box was built with the following measurements: $42.0 \times 42.0 \times 42.0$ cm, so that the two legs could be immersed simultaneously. One faucet was placed at 25 cm from the base, which served as an escape for the water displaced during the procedure. The amount of water regarding the volume occupied by the lower limbs was displaced to a container which was then weighed in an electronic scale (BD-500) with a precision of 1 g. The edema is the most common and characteristic clinical sign of venous disease, and the water displacement volumetry is considered the gold standard for its assessment (Krijnen et al. 1997b; Perrin & Guex 2000).

The activities performed by each subject investigated at the workplace were followed by direct observation, using a protocol and instruments such as a voice recorder (Sony®), photographic camera and digital film recorder (model DSC-T3, Sony®) and flexible metric tape to determine the physical area of the investigated workplace.

The posture of each worker during the whole day work was specified, as well as the time they remained standing (static or dynamic) and sitting, by the use of a digital chronometer. The displacement of the workers during the day was established through the use of a pedometer *OMRON*, model HJ-720 ITC. The physical structure of each work post-observed was detailed. The adequateness of the furniture and equipment at the worker's work spot, the psychophysiological characteristics of the workers, and the nature of the work done were also assessed.

The exposure to heat and relative air humidity was evaluated by individual analysis of each worker in their work spot, with a digital thermo-hygrometer (TFA, sensitivity of 0.1 °C and 0.1%). Measurements were done hourly in the exact location where the worker was performing her job.

The interviews, measurements, and observations of individual work occurred only once with each worker. Each participant was followed fully and individually in their working day, which allowed the assessment of work environment on different days of the week. The observation of worker's activities was always performed discreetly and without interference from the observer.

The study protocol was approved by the Research in human beings and ethics committee of the Federal University of Santa Catarina, and the procedures followed were in

accordance with the ethical standards of the responsible Committee on Human Experimentation and with the Helsinki Declaration of 1975, as revised in 1983. All subjects provided written informed consent prior to their inclusion in the study.

Results and discussion

Fourteen workers from the areas of pre-preparation and cooking of the general and dietetic kitchen, cleaning of utensils and preparation of coffee and deserts participated in the study. All individuals were females aging from 25 to 54 years. Their time on the job varied from 1 to 25 years, working in day and night shifts of 12 h with a resting period that goes from 36 to 48 h, depending on the type of contract. Their tasks are conditioned to the menu of the day and to the previously determined schedule of the hospital, following the flow of production in addition to hygiene procedures formally prescribed for the sector and placed on the walls in the kitchen area.

The diagnosis of the nutritional status based on the WHO indicators revealed that out of the 14 workers, three were considered in normal weight, and the rest were with overweight or obese in various degrees. Regarding the meals had at work, all the workers had lunch as their main meal served in the cafeteria in addition to two snacks during the day. It was observed, however, that breads, biscuits, fruits, coffee with sugar, and other snacks were always available, so they actually ate more in between the reported meals. All workers noticed that they gained weight since they started working at this meal production unit, although none of them was able to predict the exact value.

Clinical and specific examination for venous disease

It was observed the presence of different degrees of venous disease in 11 of the 14 cases. After the CEAP classification, 8 workers presented C_1 (telangiectasis and reticular veins), two presented C_2 (clinical varicose veins), one presented C_3 (varicose veins and edema), and three did not present any visible or palpable sign of venous disease (C_0). No skin change was attributed to venous disease in the participants of the study. All workers with a diagnosis of venous disease presented primary (E_P) and superficial (A_S) varicose veins. The clinical signs and symptoms of venous disorder in all diagnosed cases were a result of reflux (P_R) (Table 1).

All workers were considered symptomatic ($C_{0\text{-}6,S}$), even those without the diagnosis of venous disease. Among the reported symptoms, pain, congestion, cramps, edema, feeling of heaviness and tiredness on the lower limbs stood out. Considering the progression of the complaints throughout the day, 13 workers reported an increase in the symptoms, and one reported no change. When they were asked if walking had any influence on these complaints, four said that it helped reduce the symptoms, two said the symptoms increased, and eight said it made no difference. However, all of them reported that remaining standing for long periods of time made the symptoms worse. It is important to emphasize that all of the workers investigated believe that these complaints are directly associated with their work conditions. Finding that the complaints were more frequent and more severe among the workers with a diagnosis of venous disease ($C_{1\text{-}6}$) ratified the literature reports (Krijnen et al. 1997b).

Volumetric variation

All workers presented an increase in the volume of their feet and legs at the end of the work shift, with an average variation for volumetry of 5.1% (standard deviation

Table 1. Diagnosis of venous disease in the investigated workers according to the CEAP (clinical, etiological, anatomical, pathophysiological) classification.

	Task	Distance walked[a] (m)	Total working time[a] (min)	Time sitting	% Time sitting	Time standing[b] (min)
1	General kitchen	7828	630	45	7.14	585
2	Utensil hygiene	3320	615	75	12	540
3	Kitchen helper	5426	645	60	9.30	585
4	Kitchen helper	7078	610	64	10.49	545
5	Kitchen helper	4016	610	35	5.73	575
6	Dietetic kitchen	5109	620	145	23.38	475
7	Utensil hygiene	3197	630	111	17.61	519
8	Kitchen helper	1956	630	95	15.07	535
9	Dietetic kitchen	6348	650	20	3.07	630
10	Kitchen helper	4468	610	55	9.01	555
11	Kitchen helper	3873	685	42	6.13	643
12	Coffee	6583	580	45	7.75	535
13	Dietetic K helper	4311	600	110	18.33	490
14	Dietetic K helper	5102	625	15	2.40	610

[a]Excluding each worker's break.[b]Walking and stand.

±3.77%). The values of edema found, except for five workers, are relatively high considering those reported in the literature, like the edema expected from healthy individuals (1.2–2.4%), peripheral edema in inpatients who are hospitalized for treatment (5.9%) and edema for sedentary work and in the sitting position (4.8%), among others (Goldie et al. 1974; Winkel 1981; Winkel & Jorgensen 1986; Brijker et al. 2000; Belczak 2008).

Among the five workers who presented a normal volumetric variation during the day, three corresponded to the only ones who were not diagnosed with venous disease. The other two without edema had their medical diagnosis based on the CEAP classification: superficial reticular veins, of primary etiology, symptomatic, derived from reflux ($C_1E_PA_{S1}P_R$).

Figure 1 shows the volumetric variation observed in each worker at the end of a working day.

Taking into account the nutritional status of the workers, only one classified as normal weight did not present venous disease or edema. The other two in normal weight workers had a positive diagnosis for varicose veins, and only one presented edema. Among the 11 workers classified as overweight or obese, 9 confirmed the presence of venous disease, and 8 presented edema. Many aggravating factors of venous disease seem to act statistically synergistically with obesity. They are not independent but are

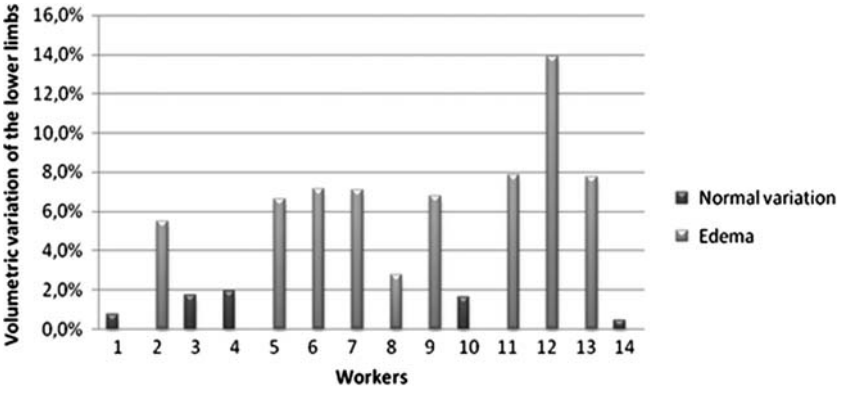

Figure 1. Volumetric variation of the lower limbs observed in the investigated workers.

linked as consequence like inactivity, little sport activity, or as promoters, like parity (Allaert et al. 1991). Therefore, obesity does not appear as a simple aggravating factor but as a context of risk to develop and potentiate many other elements that favor venous disease.

Regarding family history of venous disease, 11 workers reported having a parent or both parents with some degree of compromised veins. Of these, eight presented a medical diagnosis of varicose veins. That is, three workers of the study who did not present a diagnosis of venous disease reported having a family history for it. And, the three who did not report a family history of the disease presented a positive diagnosis for venous disease.

The use of questionnaires and interviews when investigating family antecedents for venous disease is discussed extensively in the literature. Many authors find difficulty in making a precise diagnosis based on a report of family history. Individuals with early onset of varicose veins are more likely to know their family history precisely than those with a late onset.

Direct observation

Taking into account the diagnosis of venous disease and the working time, the absence of any signs of the disease was observed in three subjects, but no relationship could be established between these two variables, as the total run time was about the same for all employees. The difference was given by the characterization of the activities performed, some being more dynamic and others more static.

The varied activities were performed predominantly in the standing position, with movements of hands and arms. Most of the time, the workers adopted postures such as bending the head and trunk over tables, counters, and vapor pans.

Time spent sitting down represented 10.82% of their workday, and it involved activities such as wrapping silverware and the pre-preparation of some vegetables. The dynamic activities observed revealed constant displacement of the workers carrying kitchen utensils, moving about the stove or going for foods in the storage area.

All workers performed repetitive movements for long periods of time, especially when removing foods that were ready from inside vapor or common pans. The mean amount of time spent standing (still or walking) was 9 h and 20 min (corresponding to

83.5% of the total work time), with a minimum of 7 h and 55 min and a maximum of 10 h and 43 min. Individual data regarding the distance walked as well as the time working in the standing position and sitting position are listed in Table 2.

The inadequate postures observed and maintained for long periods, such as when they remain static in the standing position or when they bend forward, besides carrying too much weight, are tiring and in the long run, they may cause a number of lesions. These postures and actions could be one of the causes for complaints of pain, tiredness, and feeling of edema of the lower limbs in nearly all the workers. Some authors used as marker to classify the work standing up as burdensome for venous disease the fact that the person remains in this position for more than 6 h, including also bending forward (Estryn-Behar et al. 1998). Besides the static standing and sitting postures, bending forward while standing was also positively associated with the development of venous insufficiency (Sobaszek et al. 1996).

As proven before in the literature (Parisel 1992; Sobaszek et al. 1996; Krijnen et al. 1997b), the time the worker remains standing influences the development of venous disease. These studies suggested a minimum time of 5 years and a maximum time of 20 years.

They used to carry heavy objects without assistance, like canned foods and other foods from the storage area using their clothes, as well as boxes filled with vegetables weighing more than 10 kg, once there was not enough equipment or the equipment was inadequate. One issue observed is the difference of height of the counters, the stove and the transportation carts, which forced the workers to raise any object that they needed to carry since it was not possible to slide them from one surface to another. The risk of developing varicose veins or chronic venous insufficiency attributed to carrying weight was mentioned by many authors (Sobaszek et al. 1996; Tomei et al. 1999; Hunzing 2001). According to some of them (Sobaszek et al. 1996; Hunzing 2001), carrying weights equal to or above 10 kg pose a risk of developing venous diseases.

Despite the data were collected during the winter months, a great variation of temperature was seen throughout the day according to time and area of the kitchen observed, especially regarding heat- and humidity-generating equipment. During the

Table 2. Relationship between tasks, total distance walked, total working time, time sitting, percentage of time sitting and time standing during a day of work of the investigated workers.

		CEAP classification	
Worker	Clinical classification	Anatomical classification	Pathophysiological classification
1	$C_{1,s}$	A_{S1}	P_R
2	$C_{2,s}$	A_{SS}	P_R
3	$C_{0,s}$	–	–
4	$C_{1,s}$	A_{S1}	P_R
5	$C_{2,s}$	A_{SS}	P_R
6	$C_{1,s}$	A_{S1}	P_R
7	$C_{1,s}$	A_{S1}	P_R
8	$C_{1,s}$	A_{S1}	P_R
9	$C_{3,s}$	$A_{S2,3\ and\ 4}$	P_R
10	$C_{0,s}$	–	–
11	$C_{1,s}$	A_{S1}	P_R
12	$C_{1,s}$	A_{S1}	P_R
13	$C_{1,s}$	A_{S1}	P_R
14	$C_{0,s}$	–	–

time of maximum production of the kitchen, around 10 am, the temperature near the general and dietetic kitchen stove reached 36.6 °C, while the mean outside temperature was 20 °C. During the interval between 10 am and 4 pm, the temperature remained around 30 °C and started dropping after that time.

All the individuals without exception were submitted to temperatures above those recommended as the limits for comfort and prevention of venous disease (Hunzing 2001; Ziegler et al. 2003). This occurred both by the contact with heat-generating equipment and by the fact that the environment was not well ventilated – the windows were high, and the exhaust system was precarious. Even though the maximum temperature did not correspond to the temperature, the workers were subject to most of the time; a mean minimum temperature of 22.7° C found only in the first hour of their working shift (less than 10% of the total work time), and it is also above the recommended comfort range.

The same applies for the relative humidity of the air. The mean maximum observed of 74.4% is above the recommended value of 60% which is the limit of comfort for venous disease (Hunzing 2001). The mean remained at 55.8%, within the comfort range stipulated in the same study. Even though for some time, the humidity remained within the recommended limits, and most of the time it, exceeded 60%, probably because of the inefficiency of the exhaust system.

According to reports of all workers, the thermal discomfort increases considerably during summer and fatigue and edema also increase, especially in the region of the ankles. It was observed that the vapors and gases were excessive, since the existing suction fans were not working properly, impairing the ventilation of the environment. It is also necessary to take into account that besides the relative air humidity, another aggravating factor for chronic venous insufficiency is the presence of humidity on the floor, common in this unit because of malfunctioning equipment and hygiene of the counters, stove and the floor itself.

After close observation of the subjects during their work activities, the main cause of overweight and obesity found could be attributed to the fact that they do their tasks eating all the time, which is a characteristic of the work in this sector, as related by other studies that evaluated these variables in kitchens (Matos & Proença 2003; Boclin & Blank 2006; Matos et al. 2009).

Conclusions

It was verified that, regardless of individual peculiarities, when the workers are submitted to the same work conditions, these invariably influence the onset of venous disease, which are the standing position for long periods of time, high temperature and relative humidity of the air, carrying heavy weights, and the demand for high productivity in unfavorable conditions. By observing the daily work shift, it was also possible to identify other factors that are associated with the aggravation of the picture, such as the nature of the activity which requires a repetitive and continuous work, always on a tight schedule for 12 uninterrupted hours at every 36 or 48 h, with few possibilities of taking short breaks and resting for a few minutes.

The limits of this study are the small number of patients and the absence of multifactorial statistical analysis. Although the paper presented a qualitative study, with the inherent limitations for projecting other realities, the methodology used in the study and the results obtained therewith can be redirected to other studies with similar situations. The value of the qualitative study lies exactly in attaining a deeper knowledge of a

delimitated reality, yet with results which allow the formulation of hypothesis to foster other research projects, providing an analysis model be rigorously built in accordance to the pre-established objectives and the reality to be studied.

We emphasize that the direct observation using the EWA allowed the access of the work environment, with the achievement of a greater amount of details of this environment which are usually not obtained with other methodological instruments. Since work conditions have an important role on the onset of venous diseases of the lower limbs, this association constitutes, in fact, a promising research field since these exogenous aspects (posture, temperature, carrying excess weights, long work shifts, equipment, among others) can be influenced and modified, and preventive measures can be taken.

The results obtained in this study shows the importance and the possibility of deepening the discussions surrounding this subject and suggest that a protocol should be established for the prevention and treatment of venous diseases stemming from working conditions. It could be the start of a process to identify this condition as an occupational disease, therefore, contributing for a conceptual reformulation of the obligations stemming from this professional activity.

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