

Relationship between shoulder pain and weight of shoulder bags in young women

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ORIGINAL ARTICLE

ABSTRACT

The present study aimed to assess the relationship between shoulder pain and weight of shoulder bags in young women. Cross-sectional study conducted with 316 women aged 18-35 years from February 2013 to July 2014. A questionnaire was used to collect demographic data and information on physical activity, sleeping habits, presence of pain and its characteristics, use of bags, and percentage of bag weight-body weight ratio (%bagweight). Pearson's chi-squared test and Mann-Whitney test were used to check for associations between the dependent variable (presence of pain) and the independent variables, with a significance level of 5% ($p < 0.05$). In all, 195 (61.7%) women complained of shoulder pain. These women carried heavier shoulder bags ($p = 0.01$), weighing circa 4.02% of their body weight ($p = 0.050$), and the pain was proportional to a higher bag weight ($p = 0.023$) compared to the painless group. Lack of physical activity and inadequate sleep position influenced the occurrence of shoulder pain ($p = 0.008$ and $p = 0.017$, respectively). The weight of the shoulder bag represented a risk factor for the onset of shoulder pain and women should not carry bags weighing more than 4% of their body weight.

Keywords: shoulder pain, women, prevalence, risk factors.

INTRODUCTION

Shoulder pain is one of the main complaints in the general population resulting into functional impairment. Worldwide, women are found to present higher rates of shoulder pain, particularly associated with work activities (Abdulmonem, Hanan, Elaf, Haneen, & Jenan, 2014; Meroni, Scelsi, Boria, & Sansone, 2014; Hill, Gill, Menz, & Taylor, 2010).

The shoulder is an anatomical region that undergoes different types of injuries, such as strain, inflammation, fibrosis, hypovascularization, and joint degeneration. An exposure-outcome relationship is observed between overload, work activity, psychosocial disorders, stress and unsatisfactory rest period and the presence of shoulder pain (Mendonça & Assunção, 2005).

Among the risk factors for shoulder pain, the overload imposed on the joint and muscles by the use of some female accessories, such as bags and backpacks, is harmful to its structure (Bettany-Saltikov & Cole, 2012). In addition, the characteristics of these accessories (weight, size, shape, duration of carriage) and the physical constitution of women can lead to greater damages, such as changes in body alignment, displacement of the center of gravity, excessive shoulder muscle activity, fatigue, and pain (Yoon, 2014; Dianat, Javadivala, & Allahverdi-pour, 2011).

Several studies carried out with students have analyzed the weight of these accessories and demonstrated that school bags should not weigh more than 10-20% of body weight. An increase in these percentages could cause spine curvature disorders, bad posture habits, pain, learning

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impairment, and decreased quality of life (Yoon, 2014; Dianat et al., 2011). In addition, the frequent use of heavy backpacks has a cumulative impact on this population, leading to future health problems (Ries, Martinello, Medeiros, Cardoso, & Santos, 2012).

In today's society, women are constantly confronted with many impositions of fashion regarding the models, sizes and styles of bags. They also must deal with aesthetics, which dictates what they should wear every day. Additionally, women's accumulation of tasks – work, study, family, social events, and others – coupled with the use of large and heavy shoulder bags put them at particular risk for injuries of the shoulder complex (An, Yoon, Yoo, & Kim, 2009).

However, despite what has been said above about the repercussions of the use of shoulder bags by women, just a few studies have assessed the weight limit for this type of female accessory. Therefore, our hypothesis is that the use of overweight shoulder bags can influence the occurrence of shoulder pain.

Thus, the present study aimed to assess the relationship between shoulder pain and weight of shoulder bags in young women.

METHOD

This is a quantitative analytical cross-sectional study carried out at the University of Fortaleza (UNIFOR) from February 2013 to July 2014.

Participants

Research participants were 316 (n=316) women aged 18-35 years enrolled in undergraduate programs. Exclusion criteria were: self-reported shoulder injuries, severe postural deviations, use of limb prosthesis/orthosis and obesity visible on inspection, and incomplete filling of the instruments used for data collection.

We used a nonprobability and intentional sample of students who were directly and informally contacted in the halls of the buildings and in the food court in different shifts. These places were chosen because they are home to students of several courses.

The study was approved by the research ethics committee of the University of Fortaleza

(Approval No. 54995). All participants provided their written consent.

Procedures

After sample selection, the authors developed a questionnaire on the basis of the literature (Mendonça & Assunção, 2005), which was then completed by the respondents. The questionnaire addressed demographic variables (age, children, and extracurricular activity), physical activity, sleeping habits (hours and position), presence of pain and its characteristics, dominant hand, use of bags (duration of carriage, weight in kilograms – kg, and shoulder used to carry the bag), and percentage of bag weight–body weight ratio (%bagweight), calculated using the following formula: $\% \text{bagweight} = \text{bag weight} \times 100 / \text{body weight}$.

Sleep position was self-reported and then classified into adequate (supine) and inadequate (lateral and prone) (Zenian, 2010). Pain characteristics assessed were: intensity, measured through the Visual Analog Scale (VAS), frequency and time of the day pain usually occurs. The VAS of pain intensity consists of a line with 2 descriptors representing extremes of pain intensity (e.g., no pain and extreme pain) at each end. Pain intensity is classified into mild pain (1-4), moderate (5-6) and severe pain (7-10) on a scale of 0-10 (Jensen, Chen, & Brugger, 2003).

Body weight and bag weight were measured using a Geom® digital portable scale, with a maximum capacity of 125Kg and a readability of 1Kg. Height was measured using a Sanny® portable vertical stadiometer with a 2.11m capacity and an accuracy of 0.1cm. Height was measured in meters with the participant standing erect on barefoot looking straight ahead without any hair ornaments. Participants' Body Mass Index (BMI) were then calculated (Gordon, Chumlea, & Roche, 1991).

Data (questionnaires and measurements) were collected by the researchers, who were previously trained in order to minimize interferences.

Statistical analysis

The results of the numerical variables were described as mean \pm standard deviation and the results of the categorical variables were described as absolute (n) and relative (%) values using SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). Pearson's Chi-squared test was used to check for associations between the dependent variable (presence of pain) and the dichotomous independent variables (children, extracurricular activity, physical activity, and sleep position). Mann-Whitney test was used to investigate the relationship between the dependent variable (presence of pain) and the independent variables (bag weight, %bagweight, sleep hours, and duration of carriage) after application of the Kolmogorov-Smirnov test to check the normality of distribution of variables. The significance level was set at 5% ($p \leq 0.05$).

RESULTS

The participants' mean age was 21.6 ± 3.01 years and the mean BMI was 22.9 ± 3.67 . Age and BMI were similar ($p=0.550$ and $p=0.841$, respectively) in the pain group (age = 21.52 ± 2.95 and BMI = 22.95 ± 3.62) and in the painless group (age = 21.73 ± 3.12 and BMI = 23.04 ± 3.76). Data on demographics, physical activity, sleep position and presence of pain were summarized in table 1.

Of the women who complained of pain, 99 (50.7%) reported feeling pain at night, 64 (32.9%) said that they felt pain during the day, 20 (10.2%) state that they felt pain during night and day, and 12 (6.2%) did not answer. Regarding the frequency of pain, 98 (50.2%) reported feeling pain every day, 94 (48.2%) felt pain occasionally, and 3 (1.6%) did not answer. With regard to pain

intensity, 55 (28.2%) women felt mild pain, 118 (60.5%) felt moderate pain, and 22 (11.3%) felt severe pain.

Table 1

Distribution of demographic variables, physical activity, and sleep position in young women. Fortaleza, Ceará, 2013-2014

Variables	n	%
Age group (years)		
Up to 19	85	26.9
20-24	186	58.9
25-29	35	11.1
30-35	10	3.2
Children		
Yes	22	7.0
No	294	93.0
Extracurricular activity		
Yes	83	26.3
No	233	73.7
Physical activity		
Yes	135	42.7
No	181	57.3
Sleep position		
Adequate	139	44.0
Inadequate	177	56.0
Shoulder pain		
Yes	195	61.7
No	121	38.3

As for the dominant hand, 284 (89.9%) participants were right-handed and 32 (10.1%) were left-handed. With regard to the shoulder used to carry the bag, 185 (59.5%) participants used the right shoulder, 54 (17.1%) used the left shoulder, and 77 (24.4%) used both shoulders.

The weight of the shoulder bags of the women who reported having joint pain was 8.14% heavier than that in the painless group ($p=0.01$). After calculating the percentage of bag weight–body weight ratio (%bagweight), it was found that women with pain carried bags that weighed an average of 4.02% of their body weight. Such value was significantly lower (3.78%) ($p=0.050$) in the painless group (Table 2).

Table 2

Analysis of the association of shoulder pain with the weight of the bag carried and the percentage of bag weight–body weight ratio (%bagweight) in young women. Fortaleza, Ceará, 2013-2014

Variables	Shoulder pain		p-value	Effect size
	mean \pm D.P. (median)			
	No	Yes		
Bag weight (kg)	2.21 ± 1.11 (2.00)	2.39 ± 0.96 (2.30)	0.01**	0.27
%bagweight#	3.78 ± 2.01 (3.42)	4.02 ± 1.72 (3.62)	0.050*	0.13
Amount of sleep (hours)	7.37 ± 1.62 (7.00)	7.08 ± 1.35 (7.00)	0.106	-0.20
Duration of bag carriage	2.68 ± 2.11 (2.00)	2.53 ± 2.29 (2.00)	0.241	-0.29

Note. D.P. = standard deviation. # = percentage of bag weight–body weight ratio. * $p \leq 0.05$ and ** $p \leq 0.01$, statistically different in relation to the absence of pain (Mann-Whitney test). Effect size: d-Cohen.

In addition to the previous finding, the categorization of the %bagweight into different ranges also revealed a higher number of women with pain proportional to a higher bag weight ($p=0.023$) (Figure 1).

With regard to sleep hours and duration of carriage of the bag, there were no significant differences between the pain group and the painless groups ($p=0.106$ and $p=0.241$, respectively) (Table 2).

It was observed that most of the women who had children felt shoulder pain; however, this association was not significant ($p=0.172$). Additionally, engagement in extracurricular activities did not interfere in the report of shoulder pain ($p=0.320$). Nevertheless, physical activity and sleep position were factors that influenced the occurrence of shoulder pain in the young women analyzed ($p=0.008$ and $p=0.017$, respectively) (Table 3).

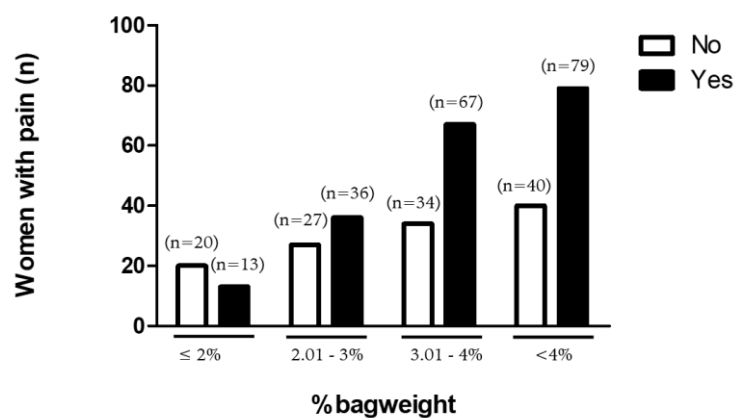


Figure 1. Distribution of women according to the occurrence of shoulder pain and the percentage of bag weight-body weight ratio (%bagweight). Fortaleza, Ceará, 2013-2014.

Table 3

Analysis of the influence of the variables children, extracurricular activity, physical activity and sleep position on the occurrence of shoulder pain in young women. Fortaleza, Ceará, 2013-2014

Variables	Shoulder pain		C.R.	p-value	Effect size
	Yes n (%)	No n (%)			
Children					
Yes	17 (8.7)	5 (4.1)	1	0.172	0.088
No	178 (91.3)	116 (95.9)	2.216		
Extracurricular activity					
Yes	55 (28.2)	28 (23.1)	1	0.320	0.056
No	140 (71.8)	93 (76.9)	1.305		
Physical activity					
Yes	72 (36.9)	63 (52.1)	1	0.008**	-0.149
No	123 (63.1)	58 (47.9)	0.539		
Sleep position					
Adequate	96 (49.2)	43 (35.5)	1	0.017**	0.134
Inadequate	99 (50.8)	78 (64.5)	1.103		

Note. C.R. = Chance Ratio. ** $p \leq 0.01$, association between variables (Pearson's Chi-squared test). Effect size: Phi coefficient.

DISCUSSION

Some conditions imposed on the shoulder complex, such as the weight of a shoulder bag, can lead to functional and anatomical changes. There are many studies on the effects of backpack use (Yoon, 2014; Hardie, Haskew, Harris, & Hughes, 2015), particularly on schoolchildren

(Dianat et al., 2011, Ries et al., 2012). However, there is a scarcity of studies on the use of female shoulder bag and on the maximum weight recommended to minimize the harmful and chronic impact on such joint.

The relationship between shoulder pain and use of bags of various sizes and shapes has been

shown in several studies across all continents; however, these studies have been mainly focused on children and adolescents (Hardie et al., 2015; Mwaka, Munabi, Buwembo, Kukkiriza, & Ochieng, 2014; Matsuo, Hashimoto, Koyanagi, & Hashizume, 2008; Zultowski & Aruin, 2008; Chansirinukor, Wilson, Grimmer, & Dansie, 2001). Some studies have shown groups with a large age range (7-17 years old) complaining of pain in different regions associated with the use of backpacks (Dianat et al., 2011; Myrtveit et al., 2014); in addition, women were found to be more vulnerable to the onset of backpack-related pain (Dianat et al., 2011).

In the present study, the study population consisted of young women – mostly aged 20-24 years old (58.9%) – using a type of bag different from that used by schoolchildren, i.e., the female bags in the present study had a unilateral shoulder strap instead of bilateral shoulder straps.

Shoulder pain is a common complaint in women that may be associated with anatomical, environmental, or social factors and that have different prevalence rates. A study conducted in Middle East with female teachers aged over 20 years showed a high prevalence (60.6%) of shoulder pain and highlighted that factors such as physical activity and satisfaction with work environment were associated with pain (Abdulmonem et al., 2014). On the other hand, research conducted in Europe with women aged 20-55 years found a lower prevalence (25.5%) of shoulder pain (Meroni et al., 2014).

In the present study, the prevalence rate (61.7%) of shoulder pain in young women aged 18-35 years was higher than those previously reported. Despite the different rates reported in the literature, the occurrence of shoulder pain in this population is of great concern as it is a working-age population of women of reproductive age; therefore, this type of pain may have a negative impact on their daily and labor activities.

Repeated exposure of the shoulder and neck muscles to heavy bags over a long period of time predisposes women of all ages to chronic pain in these regions (Shan et al., 2014). Unlike acute pain, chronic pain is not related to warning signs,

but to a symptom that persists and tends not to disappear after the elimination of the causative factor. Persistent and long-term pain can be disturbing and may cause changes in physical activity, sleep, sex life, mood, self-esteem, and family, work and leisure relationships; additionally, it can lead to negative or suicidal thoughts (Sallum, Garcia, & Sanches, 2012). Because of that, the assessment of chronic pain should be thorough – due to its multicausality – and include information on the frequency, time of the day it usually occurs, intensity, duration, among others.

Research conducted in Asia with students aged 15-19 years highlighted the schoolbag weight as one of the risk factors identified and found that more than half of the female participants (66.6%) experienced pain once a week and that 56.5% felt mild pain (Shan et al., 2014).

The pain characteristics among the participants of the present study were worse compared to those found in the Asian study (Shan et al., 2014). In our research, 50.2% of the women reported feeling pain every day and 60.5% felt moderate pain. These results suggest that the continuous carriage of heavy bags intensifies the injurious stimulus imposed on the shoulder complex and consequently worsens the symptomatology.

Such overload, regardless of bag types and ways of carrying them, causes injuries to the shoulders, arms, hands and back. Furthermore, unilateral load carriage causes postural changes, such as spine curvature (Bettany-Saltikov & Cole, 2012), spine rotation (Filaire et al., 2001) and shoulder elevation (Korovessis, Koureas, & Papazisis, 2004), in addition to excessive neck and shoulder muscle activity (Bettany-Saltikov & Cole, 2012).

As regards the muscles directly affected by heavy bag carriage, excessive upper trapezius muscle activity has been observed in a study conducted with students (Yoon, 2014). The same study also reports lower muscle activity when walking with a backpack because of weight distribution on the shoulders. However, a preliminary study in North America with volunteers (mean age of 24 years) has

investigated the effects of using unilateral strap shoulder bag and recommended its use on the non-dominant shoulder draped across the body in order to minimize postural deviations, risk of biomechanical problems and back pain in adulthood (Qureshi & Shamus, 2012).

Considering bag weight, most studies agree that people using backpacks should not carry a weight greater than 10% of their body weight (Hardie et al., 2015; Yoon, 2014; Qureshi & Shamus, 2012). However, there is a scarcity of studies on the maximum weight indicated for shoulder bags. For instance, in the study by Qureshi and Shamus (2012) on the impact of unilateral strap shoulder bag use on postural asymmetry and its repercussions, the weight used in the research was still the one recommended for backpacks, i.e., 10% of body weight.

In addition to the weight of the bag and the different ways of carrying it, other factors may also influence the occurrence or worsening of shoulder pain in young women. A study with European female students showed that physical activity reduced the risk of NSP – a protective relationship directly proportional to the frequency of physical activity (Myrtveit et al., 2014). Another study conducted with women with chronic shoulder pain has proven the effectiveness of a physical exercise protocol in the improvement of this symptomatology (Karlsson, Gerdtle, Takala, Andersson, & Larsson, 2016). In agreement with these findings, the results of the present study revealed that physically active women less reported that shoulder pain, which suggests a positive association between regular physical activity and the reduction of such symptom.

Still with regard to potentially influencing factors, a study conducted with young women reported that insufficient quality and quantity of sleep at 16 years of age may cause pain in the future (Auvinen et al., 2010). Another study has reported an increase in the prevalence of NSP in women who slept 6 hours or less a day. The same study highlights that these insomnia symptoms are more frequent in the population experiencing chronic pain (Salazar, Dueñas, Ojeda, & Failde, 2014). In the present study, the amount of sleep,

measured in hours, did not prove to be a relevant factor for the occurrence of shoulder pain.

However, when sleep position was analyzed, women with pain were found to sleep in an inadequate position, which suggests that this habit may be a risk factor for the onset of shoulder pain. In the present study, the supine position was chosen as adequate because there is greater muscle relaxation and less stress at shoulder joint and spinal curvature. In agreement with this finding, a meta-analysis of the relationship between sleep position and shoulder pain conducted by Zenian (2010) showed that the lateral position is considered potentially harmful because it entails a smaller area of contact between the body and the bed and therefore a greater pressure on this body region. In addition to this, immobility in this position may exacerbate pain due to the recurrent effect of the sleep position.

Finally, the present study showed a high prevalence of shoulder pain in a young population. In addition, the characteristics and intensity of this symptomatology have been highlighted and have pointed to a chronic pain condition. It was also important to consider some habits as potential risk factors – for instance, lack of physical activity and sleep position.

The limitations of this study were that specific shoulder pain patient-reported outcome measures, such as the American Shoulder and Elbow Surgeons (ASES) questionnaire and the Shoulder Pain and Disability Index (SPADI) were not used; instead, we only measured the presence of shoulder pain, as we believed that the self-report of pain would be enough to relate to the bag weight. In addition, despite observing a positive relationship between active women and painless shoulder, neither the type nor the intensity of these physical activities were evaluated, which impeded to establish a possible protective muscular mechanism that may have prevented pain in the women who participated in this study

The results of the present study point to the need for educational actions with a focus on this issue in order to prevent women from experiencing pain in their bodies at an early age. Furthermore, women should carry no more than

4% of their body weight when using a shoulder bag. In situations where they need to carry heavier weights, they should use other types of accessories, such as bilateral strap backpacks or wheeled bags, not exceeding the weight limit indicated in the literature.

Finally, longitudinal studies are needed to clarify biomechanical and postural changes deriving from shoulder bag weight using specific questionnaires on shoulder pain, photometry and baropodometry.

CONCLUSION

There was a high frequency of everyday pain (50.2%) and moderate-intensity (60.5%) shoulder pain in the young women assessed in Northeastern Brazil. The weight of the shoulder bag represented a risk factor for the onset of shoulder pain and women should not carry bags weighing more than 4% of their body weight.

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Nothing to declare.

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