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Cumulative effects of Swedish massage and physical exercise on anthropometric parameters and pain intensity in women suffering from low back pain in Yaounde (Cameroon)

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Abstract
Introduction: Low back pain is often intense pain in the lumbar vertebrae of the lower back. It has a wide variety of causes and can have serious consequences. Objective: The aim of this intervention study was to evaluate the cumulative effects of massage and physical exercise on low back pain in women in the city of Yaoundé.
Methods: Thirty (30) women suffering from low back pain divided into three (03) groups of ten (10) participated in a 21-day micro-program of physical activity combined with localized massage. Group 1 (G1) was made up of women who did only physical exercise. Group 2 (G2) consisted of women who had only undergone Swedish massage sessions. Group 3 (G3) was made up of women who had undergone both physical exercise and Swedish massage. The variables were measured at the beginning and end of the physical exercise program.
Results: The results showed a significant decrease in body mass ($p< 0.01$) and fat mass ($p< 0.01$) in all three groups. The study also revealed that massage and physical exercise induced a significant reduction in the intensity and appreciation of discomfort caused by pain in women in all groups. This reduction in pain intensity and discomfort was more marked in G3 ($p< 0.001$) than in the first two groups G2 and G1 ($p< 0.01$).
Conclusion: It is suggested that physical exercise combined with Swedish massage tends to have more marked positive effects on the risk factors associated with low back pain than physical activity or Swedish massage used separately.

Keywords: Physical exercise, Swedish massage, low back pain, women, Cameroon

1. Introduction
Low back pain, commonly known as "backache" or "lumbago", is pain, often intense, in the lumbar vertebrae at the base of the back. This pain can worsen and spread to the buttocks and down to the back of the knee [1]. It manifests as a sensation of blocking or difficulty in performing certain movements [1]. It is generally described as pain located between the twelfth rib and above the lower gluteal fold, accompanied or not by pain in the pelvic limbs [2]. It has a multifactorial origin, in particular occupational risk factors. In addition to these factors, there are personal predispositions, intercurrent pathologies, risks taken during domestic and leisure activities and the psychosocial risks of life outside work [3].
The causes of low back pain are multiple, difficult to identify and often interrelated. They include wear and tear of the intervertebral discs, vertebral osteoarthritis, spinal deformities and a history of back trauma [4]. However, in some cases (5-10%), back pain is related to a potentially serious underlying disease, which needs to be diagnosed early [4]. During their lifetime, around 80% of people will experience a period of back pain [3, 5]. This problem creates several limitations in a person's life and has personal, social and economic consequences [3, 5, 6].
Low back pain is generally treated with drug therapy, often prescribed by physicians to relieve the patient's pain. In addition to this drug option, physical activity, a non-drug therapy, has been shown to improve the health and quality of life of patients with low back pain by

significantly reducing pain. Massage, particularly Swedish massage, has also been shown to improve well-being and help relieve lower back pain. As a result, massage therapy is increasingly being used to treat various health problems such as low back pain [7].

In Cameroon, several studies have established the variation in the prevalence of this condition in different socio-professional groups. A study conducted between January 2005 and June 2007 at the Yaoundé Central and General Hospitals on 84 adult female secretaries and office workers aged between 24 and 68 showed that 20 women suffered from S1 sciatica (23.81%) and 59 suffered from low back pain accompanied by L5 sciatica. The women most at risk were both obese and grand multiparous [8]. Preliminary results on lumbar degeneration show that women represent 62% of patients suffering from sciatica and 68% of patients suffering from a narrow lumbar canal, all non-traumatic causes combined [9]. When people consult a doctor, it is generally when the pain reaches a level that completely interferes with their quality of life. What's more, low incomes do not always allow people to pay for medical care. In this situation, it is necessary to propose a non-drug alternative, namely massage and physical activities to relieve lower back pain. The aim of this research is therefore to study the combined or separate effects of a physical activity program and Swedish massage on lower back pain in women.

2. Materials and Methods

2.1 Setting and type of study

This longitudinal study was carried out according to a quasi-experimental design over 21 days at the Institute National of youth and Sport in Yaoundé, Cameroon.

2.2 Participants

Thirty (30) women suffering from low back pain (acute and subacute) took part in the study. The subjects were divided into 03 groups of ten (10) each. The first group (G1) and the second group (G2) were subjected to a physical activity program and Swedish massage sessions respectively. The third group (G3) underwent a combined program of physical activity and Swedish massage. All the participants, aged between 20 and 70, had given their free, informed and written consent beforehand. During the course of the study, all women who were ill or had been absent during a data collection period, or had missed a total of more than three (03) physical exercise sessions or five (05) massage sessions, were excluded from the final sample. Thus 6 women out of the 36 initially selected were excluded.

2.3. Materials and data collection tools

A Chinese-made TANITA CB 730 bio-impedance meter was used to measure body mass, body fat and body water. A rigid, removable GM type measuring tape, accurate to within 0.1 cm and graduated from 0 to 250 cm, was used to measure height. A valid chronic pain assessment questionnaire was used to record personal information, general information; reasons for consultation, pain intensity and discomfort caused by low back pain (see Appendix).

2.4. Experimental protocol

Two programs were implemented during this intervention. The physical exercise program and Swedish massage session.

The physical activity program consisted of four weekly fitness sessions lasting 1 h 00 min, giving a total of 12 sessions. Each session included a warm-up (5 min), a warm-down (15 min), the main part (30 min) and a cool-down (10 min).

The work intensity was between 55 and 70% of maximum heart rate. Recovery was passive and active between exercises. The physical exercise program aimed to improve aerobic endurance, flexibility and muscle strengthening.

The Swedish massage treatment was carried out by a team of three massage therapists trained in Swedish massage techniques based essentially on effleurage, friction, kneading, percussion and vibration. The program included four massage sessions per week. The women therefore received a total of 12 sessions. The massage focused on the back area, mainly the lumbar region. The average massage session lasted one hour. For G3, who did both exercise and massage, the massage session took place an hour after the exercise session.

2.5. Variables

In this study, anthropometric measurements, pain description, pain intensity and pain discomfort were the dependent variables.

Pain was described using 16 items, each assessed in four modalities: mild, moderate, severe and extremely severe. The intensity of the pain was assessed using a scale from 0 to 10, which allowed the intensity to be assessed in terms of 5 aspects: pain at the present time, pain over the previous 8 days, the most intense level of pain over the previous 8 days, and the level of pain deemed acceptable by the patient. The discomfort caused by the pain was identified through the aspects of daily life that it influences, i.e. mood, ability to walk, activities of daily living, relationships with others, sleep and enjoyment of life. Each aspect was assessed using a scale from 0 to 10, where 0 corresponds to 'no discomfort' and 10 to 'maximum discomfort'.

2.6. Statistical analysis

Data were organized using MS Excel 2010, and statistical processing was carried out using STATISTICA version 10. Descriptive statistics were presented in the form of mean and standard deviation. The Wilcoxon rank test was used for intra-group comparisons. The ANOVA test and Tukey's post hoc test were used for inter-group comparisons. The significance level of the tests was set at $p< 0.05$.

3. Results

3.1. Anthropometric parameters

At the end of the 21 days, the results showed that body mass and fat mass decreased significantly ($p< 0.01$) in all three groups. The reduction in body mass was 2.20%, 1.38% and 1.57% respectively in G1, G2 and G3. Changes in body fat were 14.96%, 4.92% and 5.56% in G1, G2 and G3 respectively (Table 1). Changes in the other parameters were not significant.

3.2. Pain intensity

At the end of the intervention, pain intensity fell in all the groups and in all the aspects taken into account for the assessment of pain intensity (Table 2). Pain felt at the present time decreased by 57.97% ($p< 0.01$), 56.94% ($p< 0.01$) and 56.75% ($p< 0.01$) in G1, G2 and G3 respectively. In all three groups, habitual pain regressed ($p< 0.01$). This regression was 57.35% in G1; 58.44% in G2; 57.74% in G3 (Table 2). Similarly, the most intense pain and the acceptable level of pain decreased significantly ($p<0.01$) in all groups (Table 2), respectively by 56.97% for G1; 58.33% for G2; 61.11% for G3 and by 72.88% for G1, 74.24% for G2 and 68.51% for G3.

Table 1: Values of anthropometric parameters for the different groups at the start and end of the experiment

Paramètres	Groupe 1 (G1)		Groupe 2 (G2)		Groupe 3 (G3)	
	Beginning	End	Beginning	End	Beginning	End
Body Mass	91.91±14.88	89.80±14.37**	87.85±18.54	86.63±18.74**	93.74±17.85	92.26±18.08**
Δ (%)	-2.20		-1.38		-1.57	
Water Mass	42.01±5.05	45.16±4.28*	44.61±8.36	43.95±8.22	39.22±2.67	40.61±3.14**
Δ (%)	7.49		-1.47		3.54	
Muscular mass	46.99±5.36	47.12±7.70	41.84±6.43	43.61±4.22	45.40±6.93	46.84±6.35**
Δ (%)	0.27		4.23		3.17	
Body fat Mass	46.43±9.19	39.48±9.71**	42.63±13.49	40.53±13.42**	45.79±9.84	43.24± 9.49*
Δ (%)	-14.96		-4.92		-5.56	
Bone mass	2.46±0.23	2.78±0.41	2.71±0.45	2.70±0.46	2.73±0.34	2.80±0.33
Δ(%)	13.00		0.36		2.56	

*: Significant difference with baseline, significant at $p< 0.05$; **: Difference with baseline, significant at $p< 0.01$; Δ: Variation between end and baseline expressed as a percentage.

Table 2: Average pain intensity values in the different groups by assessment modality

Parameters	Group 1		Group 2		Group 3	
	Beginning	End	Beginning	End	Beginning	End
Present Moment Pain	6.90±1.79	2.90±1.66**	7.20±2.44	3.10±1.66**	7.40 ±2.22	3.20±1.39**
Δ (%)	-57.97		-56.94		-56.75	
Usual pain	6.80±1.68	2.90±0.99**	7.70 ±2.16	3.20±1.03**	7.10±2.02	3.00±1.15**
Δ (%)	-57.35		-58.44		-57.74	
Most intense pain	8.60±0.96	3.70±0.67**	8.40±1.89	3.50±1.17**	7.20±2.93	2.80±1.22**
Δ (%)	-56.97		-58.33		-61.11	
Acceptable Pain Level	5.90±1.59	1.60±0.69**	6.60±2.45	1.70±0.82**	5.40±1.57	1.70±0.82**
Δ (%)	-72.88		-74.24		-68.51	

**: Difference from baseline, significant at $p< 0.01$; Δ: Variation between baseline and endpoint expressed as a percentage.

3.3. Level of discomfort caused by pain

The results also showed that all aspects related to the level of discomfort caused by pain decreased significantly ($p< 0.01$) at the end of the intervention in all groups. Mood improved by 52.23%, 65.21% and 65.67% respectively in G1, G2 and G3; discomfort related to walking ability decreased by 61.64%, 71.79% and 69.51% respectively in G1, G2 and G3. Discomfort related to the ability to work as usual fell by 63.93%, 70.27% and 64.10% respectively in G1, G2 and G3. Discomfort related to relationships with others decreased in G1, G2 and G3 by 77.77%, 88.13% and 84.48% respectively. Pain-related sleep disorders also fell by 81.81% (G1), 67.18% (G2) and 67.18% (G3).

Table 3: Average values for discomfort caused by pain in the different groups

Parameters	Group 1		Group 2		Group 3	
	Beginning	End	Beginning	End	Beginning	End
Mood	6.70±1.88	3.20±1.31**	6.90±2.68	2.40±2.0^{6**}	6.70±1.63	2.30±1.56**
Δ (%)	-52.23		-65.21		-65.67	
Walking ability	7.30±1.56	2.80±1.39**	7.80±2.65	2.20±1.61**	8.20±1.03	2.50±1.17**
Δ(%)	-61.64		-71.79		-69.51	
Usual work	6.10±1.85	2.20±0.78**	7.40±2.87	2.20±1.47**	7.80±1.13	2.80±0.42**
Δ(%)	-63.93		-70.27		-64.10	
Relationships with Others	4.50±2.27	1.00±1.24**	5.90±3.63	0.70±0.94**	5.80±1.87	0.90±0.99**
Δ(%)	-77.77		-88.13		-84.48	
Sleeping	4.40±2.06	0.80±0.90**	6.40±3.13	2.10±1.44**	6.40±2.54	2.10±0.99**
Δ (%)	-81.81		-67.18		-67.18	
Taste for life	1.50±0.00	0.00±0.00***	1.30±2.66	0.00±0.00***	2.70±2.66	0.00±0.00***
Δ (%)	-100.00		-100.00		-100.00	

: Difference from baseline, significant at $p< 0.01$; *: Difference from baseline, significant at $p< 0.00$; Δ: Variation between end and baseline expressed as a percentage.

4. Discussion

The aim of this study was to evaluate the cumulative effects of Swedish massage and/or physical exercise on women suffering from low back pain in the city of Yaoundé. A valid chronic pain assessment questionnaire was used to characterize the patients' pain and, above all, to measure the intensity of this pain as well as the discomfort caused by it. The physical exercise program led by PE teachers and the massage sessions provided by massage therapists trained in Swedish massage techniques gave this study its validity and reliability.

4.1. Hydration strategy during exercise

The present study revealed that physical activity induced subjects to consume more water. Indeed, during exercise, the subjects felt thirstier, which led them to drink more [10]. This water was captured by the muscles for better functioning. When practicing physical activity, it is important to have a good hydration strategy in order not only to maintain a good level of performance but also to guarantee good health by avoiding dehydration [11]. This hydration strategy is all the more important as Cameroon is located in a humid tropical zone, where the hot and humid environment encourages

dehydration.

4.2. Changes in anthropometric parameters

The results of this study show that at the end of the intervention, body mass and fat mass decreased in all groups. It is well known that regular long-term physical activity promotes lipolysis, i.e. the use of lipids (GLA and triglyceride) as an energy substrate. This in turn leads to a reduction in body mass through the depletion of non-essential fat stocks [12]. For this reason, it is often advisable to engage in moderate-intensity, long-term physical activity. The results of the present study are confirmed by the findings of Nocon & al. (2008) [13] and Bouchard *et al*. (2017) [14], who have shown that regular physical exercise is beneficial and likely to reduce body fat by inducing a reduction in an individual's body mass.

4.3. Effect of massage

The reduction in body mass and fat mass observed during the intervention period could also be explained by the effects of massage [15]. Indeed, massage heals the body in a thousand ways, it can help to lose weight, get rid of excess fat, reduce cellulite and improve digestion. It is an effective way for obese people to reduce their body mass. What's more, this reduction is more pronounced if massage and physical exercise are combined [16]. This is because they have shown that many exercises help to reduce body mass. When muscles are sore, their performance decreases during exercise. Massage relieves sore muscles, allowing you to perform better during exercise and burn more calories, thereby improving body mass loss. When massage is applied to targeted areas of cellulite, it breaks down fat and improves appearance, reducing body mass while making the individual appear slimmer. It also allows lymphatic drainage, improving blood circulation through the use of effleurage and kneading movements, in order to reduce the body's toxin levels. Massage is therefore a complementary therapy and should be combined with any other treatment. For example, combining it with regular exercise is probably an excellent way of controlling body mass [15] and reducing pain.

4.4. Pain intensity

The results of this study showed that, at the end of the intervention period, the intensity of pain decreased in all aspects observed in all groups. This situation, which was more marked in the physical activity group combined with Swedish massage, could reflect the greater effectiveness of the combination of the two therapeutic activities compared with each activity taken separately. However, it was pointed out that physical activity or Swedish massage used separately were equally effective in reducing the level of back pain. It is probably with this in mind that regular physical activity has been recommended as a way of relieving back pain [17]. However, this activity should be adapted to the individual's condition so as not to aggravate the pain or discourage him or her. According to Chéron (2017) [17], walking and its variants, such as Nordic walking and hiking, are particularly recommended for back pain. These activities build back muscles and strengthen postural muscles while maintaining the physiological curvature of the spine. It is also important to add stretching exercises for the back muscles, which are often overworked on a daily basis. These stretches help to restore a healthy balance that is good for the back.

In addition, several authors have shown that Swedish massage is a versatile technique with multiple benefits [18, 19, 20]. Both invigorating and relaxing for the muscles, it also encourages blood and lymph circulation and the elimination of toxins. Particularly soothing, it is appreciated for its ability to reduce the effects of stress. Firmer and more vigorous, Swedish massage is ideal for releasing muscular tension and relieving pain caused by poor posture, repetitive movements or a sports injury. However, before applying Swedish massage, a clear diagnosis must be made to identify the type of musculoskeletal disorder from which the subject is suffering.

Swedish massage is therefore recommended in cases of acute or chronic back or lumbar pain [15, 21]. Its benefits have also been recognized in the post-operative field or to relieve osteoarthritis. Thanks to the vigorous movements performed during massage, blood circulation increases, thereby improving muscle elasticity [22].

Discomfort caused by pain was also reduced in all groups. The reduction in this discomfort reflects the improvement in the quality of life of the subjects, who in the present study had better sleep at the end of the intervention period, a greater ability to walk with greater ease and to carry out their daily activities. This improvement is thought to be due to the effects of the various treatments administered to the participants. The present results are in line with those of Koes & al. (2010) [23], who showed that therapeutic exercises help to improve physical fitness (strength, flexibility and range of movement) and reduce pain, and are important for people suffering from back pain. Similarly, the work of Hall & al. (2018) [24] and Hartvigsen & al. (2013) [25] has also shown that physical exercise relieves back pain, even if the pain does not disappear completely. In this sense, physical activity is a non-medicinal option that alleviates pain and discomfort while improving the range and comfort of movement. It was noted that in the group practicing the combination of physical activity and Swedish massage, there was a greater reduction in discomfort caused by pain at the end of the intervention. This improvement could be explained by the combination of physical activity and Swedish massage. It is often pointed out that the combination of these two non-drug therapeutic options would be more satisfactory for patients suffering from acute and chronic low back pain [26].

This study suggests that in women from Central Africa, and particularly Cameroonian women suffering from low back pain, the practice of adapted physical activity of moderate intensity and long duration (45 minutes on average) combined with Swedish massage could reduce the intensity of the pain and the discomfort caused by it. However, future work on a larger sample including men, over a longer period and with iterative measurements, could provide a better understanding of the effect of this practice on pain in men and women, by including a better assessment of the kinetics of pain reduction.

5. Conclusion

The present study determined the effect of a physical exercise program and Swedish massage on low back pain in women in Cameroon. The results showed that these two therapies, applied for 21 days, reduced body mass, pain intensity and discomfort.

It was also shown that the combination of physical exercise and Swedish massage was more effective than each of these therapies used separately. In view of the results, it is necessary to promote regular physical activity for general health and for the treatment of low back pain. It is also necessary to recommend the combination of Swedish massage and physical activity in the treatment of this condition.

6. Conflicts oF Interest

The authors declare no conflicts of interest.

7. Authors' Contributions

All the authors participated in this study: research idea, drafting of the research project, implementation of the intervention, statistical processing, drafting, proofreading and correction, and they approved the final version of the manuscript.

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Appendix

Chronic Pain Assessment Questionnaire

This questionnaire is a tool to help with pain assessment and treatment consultations. Its purpose is to identify the pain you are experiencing and its repercussions. We ask you to answer all the questions, but if you have a problem with one of them, don't dwell on it; it will be discussed during the consultation. You can also ask your referring doctor to help you with the first part. This self-administered questionnaire should be sent to the secretariat of the pain assessment and treatment consultation so that it can be assessed and you can be offered an appointment.

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Identification

Names: ..... First names: .....
Sex: ..... Age: .....
Profession: ..... Tel: .....
Marital status: ..... Domicile: .....

Physical parameters

Body mass: ..... Height: .....
Water mass: ..... Waist size: .....
Muscle mass: ..... Arm circumference: .....
Body fat in %: ..... Hip circumference .....
Bone mass: .....:.....

Other parameters

Reason for request for consultation.....
.....
GP: .....
Have you ever been referred for a pain consultation (other than here) so that you can be assessed and offered an appointment?
☐ Yes, where.....
☐ No .....

Medical History (Illness)	Surgical History (Date)
……	……
……	……
……...	……
……	……
……	……

Current drug treatments

Other therapies

Massotherapy	PAS	Other
Physiotherapy	Acupuncture	

Examinations carried out and results

Examinations	Results

Treatment you have already tried and stopped (and why)

Treatment tested	Causes of treatment discontinuation

Pain intensity measurement

Below you will find a scale numbered from 0 to 10 to assess the intensity of your pain. This is a personal and subjective assessment; under no circumstances should you compare yourself to someone close to you suffering from pain.
The number 0 corresponds to "no pain", the number 10 corresponds to "maximum pain imaginable".

Pain at the present moment										
0	1	2	3	4	5	6	7	8	9	10

Usual pain for the last 8 days										
0	1	2	3	4	5	6	7	8	9	10

Most intense pain in the last 8 days										
0	1	2	3	4	5	6	7	8	9	10

Acceptable level of pain										
0	1	2	3	4	5	6	7	8	9	10

Pain qualification below is a list of words to describe pain. To specify the type of pain you are currently feeling (for the past two

weeks), answer by marking the answer that suits you:

	0 Absent	1 Low	2 Moderate	3 Strong	4 Extremely strong
Slenderness					
Penetrating					
Stab					
In a vice					
Pulling					
Burn					
Tingling					
Electric shocks					
Heaviness					
Exhausting					
Anguish					
Obsessive					
Intolerable					
Annoying					
Maddening					
Depressing					

For each of the following 6 questions, circle the number (the number 0 corresponds to "no discomfort", the number 10 corresponds to "maximum discomfort" which best describes how, in the previous weeks, the pain bothered your:

Mood										
0	1	2	3	4	5	6	7	8	9	10

Walking ability										
0	1	2	3	4	5	6	7	8	9	10

Usual work (domestic work and outside the house)										
0	1	2	3	4	5	6	7	8	9	10

Relationship with others										
0	1	2	3	4	5	6	7	8	9	10

Sleep										
0	1	2	3	4	5	6	7	8	9	10

Taste of living										
0	1	2	3	4	5	6	7	8	9	10

What do you think is the main cause of your pain?

……

What are the things that make your pain worse?

……

What are the elements that relieve your pain?

……

What are your expectations regarding the pain consultation?

……

What is your main objective? What goal would you like to achieve?

……

What are your other goals?

……

Do you have anything else to share with us?

……