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(54) **SOFT AND ELASTIC JACKET**

(57) A soft and elastic jacket is provided. No less than 70 percent of the body circumference of the soft and elastic jacket is composed of an elastic weft knitted fabric, when the soft and elastic jacket is in a motionless state without being worn. The elastic weft knitted fabric is produced by knitting 5~15% weight of elastic yarns with the rest of non-elastic yarns, and it has a basis weight of 140-200 g/m². The elastic weft knitted fabric has a tightness index of not greater than 0.8 and a recovery stress

of 0.3~1.3 N at an elongation range of 30~80%. The respiratory quotient is not greater than 1.05, when a person wearing the soft and elastic jacket exercises at an intensity of less than 7 Mets and a body exercise amount of not greater than 25 Mets·hr for an exercise time of less than 6 hrs. The soft and elastic jacket has a clothing pressure of 0.6 kPa or less in a motionless state, and 2.5 kPa or less in a motion state.

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DescriptionTECHNICAL FIELD

[0001] This invention relates to a soft and elastic jacket.

BACKGROUND ART

[0002] People are increasingly paying attention to their own health, daily dietary and life quality, and people doing various kinds of exercises are increasing. Therefore, the people's requirements, especially the performance requirements for the exercise garments, such as sportswear, have been raised accordingly. A soft and elastic jacket integrating comfortableness with sports function becomes a new demand of the people.

[0003] At present, for elastic jackets for sports available in the market, the designs thereof are usually focused on how to acquire high elasticity or on how to splice and cut different elastic fabrics such that the elasticity in different portions is different. For certain portions, high elastic fabrics are used to enhance tightening force on the wearer's muscles contacting these portions. For example, Chinese Unexamined Patent Publication CN101351129A discloses an exercise garment which exerts tightening forces on the scapulae and scapulae-surrounding muscle groups, so as to improve the exercise performance in various types of exercise accompanied by rotation of the trunk and movements of the arms. There are also examples in which taping theory is used to exert tightening forces on different parts. For example, Chinese Unexamined Patent Publication CN 101056551A discloses a compression garment which has the first and second panels of stretchable material joined by a seam. The seam is adapted to correspond to the part of a muscle ridge. The taping theory is used to tighten the muscle ridge and therefore to improve the exercise ability and performances. The elastic fabrics used in these prior art technologies are high elasticity fabrics which exert high tightening forces on human body. For peoples like professional athletes with well developed muscles, their sports performances can be improved by wearing these compression garments. However, for ordinary sports enthusiasts, they may easily feel tired and discomfort, because these compression jackets may tighten the enthusiast's muscles too strong to a too tight state when worn, and may excessively increase burden on the muscles and even the hearts when worn for a long time due to the enthusiasts doing not have hard muscles like professional athletes.

DISCLOSURE OF THE INVENTION

[0004] The purpose of the present invention is to provide a soft and elastic jacket.

[0005] The technical solution of the present invention is:

[0006] A soft and elastic jacket, wherein no less than 70% of the body circumference of the soft and elastic jacket is composed of an elastic weft knitted fabric, when the soft and elastic jacket is in a motionless state without being worn. The elastic weft knitted fabric has a tightness index of not greater than 0.8 and a recovery stress of 0.3~1.3 N at an elongation range of 30~80%.

[0007] The term "tightness index" referred to here means a degree of compression provided by clothing to a human body. It is measured with an IT-DRS stretching fatigue testing machine from INTEC Company of Japan according to the method specified in JIS L-1096. Sample specimens of 10 cm×15 cm in size are taken separately in both the warp and weft directions. The sample specimens are pulled at a speed of 30 cm/min to 110% with a clamping interval of 7.6 cm and a width of 2.5 cm, and finally, the values of the stress at 30% and 80% elongations are read, respectively. The tightness index is calculated as follows:

$$\text{Tightness index} = ((\text{Stress of elastic weft knitted fabric at 80\% elongation } \langle N1 \rangle - \text{Stress of elastic weft knitted fabric at 30\% elongation } \langle N2 \rangle) / 50) \times 10.$$

[0008] In addition, a method for determining the recovery stress is as follows: a tensile testing machine from A & D Company of Japan is used for the determination according to the method for determining elongation recovery rate and residual elongation rate specified in JIS L-1096. Specifically, the elastic weft knitted fabric is pulled once until the stress thereof reaches 20 N, and the values of the recovery stresses at 80% recovery rate and at 30% recovery rate are read, respectively. The recovery stress has close correlation with the comfort level in actual wearing situation. The less the recovery stress is, the more compression and comfort a wearer feels.

[0009] The respiratory quotient is not greater than 1.05, when a person wearing it exercises at an exercise intensity of less than 7 Mets and a body exercise amount of not greater than 25 Mets·hr for an exercise time of less than 6 hrs. The term "exercise intensity" referred to here means a degree of physiological stimulation of human body caused by physical exercise. A quantification method thereof is carried out by using oxygen consumption. The exercise intensity

for consumption of one kilocalorie per hour per kilogram of body weight is defined as 1 Met. A body exercise amount is the product of the exercise intensity and an exercise time. Unlike compression garments commercially available for professional athletes, the designers paid specific attention to the characteristics of normal sports enthusiasts when designing the soft and elastic jacket. The sports enthusiasts with a habit of daily exercising at an appropriate amount of exercise are the main object of the designer's study. The appropriate amount of exercise is specified in the present invention as a monthly amount of exercise of 50 to 1000 Mets·hr.

[0010] The term "respiratory quotient" ("RQ" for short) refers to the ratio of the volume or molar of carbon dioxide released to the volume or molar of oxygen absorbed in an organism in a specified time, i.e. the ratio of the molecular of CO₂ released to the molecular of O₂ absorbed in respiration. Sugars, fats and proteins have different CO₂ outputs and O₂ consumptions when oxidized. Therefore, these three substances have different respiratory quotients. The respiratory quotients can be classified as protein respiratory quotients and non-protein respiratory quotients. The protein respiratory quotient can be measured by measuring the amount of urinary nitrogen quantity in a specified time, and then calculating the amount of the protein decomposed in vivo based on the amount of urinary nitrogen, and calculating the O₂ consumption and CO₂ output during the decomposition of the proteins. Thus, the non-protein respiratory quotient, i.e., the respiratory quotient of the sugars and fats, can be calculated by subtracting the O₂ consumption and CO₂ output during the composition of the proteins from the measured total O₂ consumption and total CO₂ output. Since more fats are consumed than sugars are in an exercise, the exercise an exerciser does when the non-protein respiratory quotient is small is called as aerobic exercise, which is healthful. In fact, the amount of the proteins for oxidation is so small, in comparison with those of fats and sugars, it can be negligible. Thus, a mixed respiratory quotient so measured can be reckoned as non-protein respiratory quotient. In other words, the smaller the measured value of the respiratory quotient value is, the higher the degree of aerobic exercise an exerciser does is, and the healthier for the exerciser is.

[0011] In actual determination, the oxygen consumption and carbon dioxide output of a sports enthusiasts is measured by using a cardio-pulmonary function tester from JAEGER Company of German, and the body weight of a sports enthusiasts is measured by using a human body precision balance from METTLER Company of Japan. Thus, the exercise intensity and the respiratory quotient can be obtained by using the following equation:

$$\text{Exercise intensity} = \text{Oxygen intake } \langle \text{mL/min} \rangle / (\text{Sports enthusiast's body weight } \langle \text{kg} \rangle \times 3.5 \langle \text{mL/kg} \cdot \text{min} \rangle)$$

[0012] Respiratory quotient = Oxygen intake <mL/min> / Carbon dioxide output <mL/min >

[0013] The clothing pressure of the soft and elastic jacket is 0.6 kPa or less in a motionless state, 0.60 kPa or less in a portion between the elbow portion and the wrist portion, 0.33 kPa or less in the chest portion, and 0.40 kPa or less in the back side. The clothing pressure is 2.5 kPa or less in a motion state, and 1.25 kPa or less in a portion between the elbow portion and the wrist portion, 0.45 kPa or less in the chest portion, and 1.85 kPa or less in the back side. The clothing pressure is measured by using a contact pressure tester, in which the diameter of a bag as used is 20 mm, from AMI Company of Japan. The determination is made simultaneously at three points: chest, back and forearm (a portion between the elbow portion and the wrist portion). The term "a motionless state" refers to a state in which the body is upright and the arms are sagging naturally, and the term "a motion state" refers to a state in which exercises, such as lateral-raising, front-raising, stretching downwards, elbow flexion, expanding the chest, golf swing, doing horizontal push-ups, running, riding bicycle, etc., are done to a certain level over a period of time.

[0014] The elastic weft knitted fabric in the present invention is produced by knitting 5~15% weight of elastic yarns with the redundant rest of non-elastic yarns, and has a basis weight of 140-200 g/m². If the content of the elastic yarns is lower than 5%, the tightness index of the elastic weft knitted fabric will exceed 0.8 and the recovery stress on the body will also exceed 1.3 N at 30~80% elongation, or the elastic weft knitted fabric can not be stretched to 30~ 80%. If the content of the elastic yarns is higher than 15%, the content of the elastic yarns will be too high, such that the tightness index of the elastic weft knitted fabric will exceed 0.8 and the recovery stress on the body will exceed 1.3 N at 30~80% elongation. In other words, the content of the elastic yarns being too low or too high will cause the wearer too tight and difficult to exercise when wearing the elastic jacket.

[0015] The elastic yarns are polyurethane fibers. The non-elastic yarns are modified PET fibers and/or polyamide fibers.

[0016] The non-elastic yarns are preferably cationic dyeable PET fibers.

[0017] The advantages of the invention are as follows: since the elastic weft knitted fabric of the soft and elastic jacket has an appropriate tightness degree, the elastic jacket can be stretched or recovered freely following stretching or recovery of the body skin caused by the wearer's movement within the range of normal exercise movement. Thus, the elastic jacket can reduce the energy excessively generated by human body for resisting the compression from the jacket. On the other hand, the jacket can timely expand or recover to follow stretching or recovery of the body skin caused by wearer's movement. As compared with the elastic jackets of the same kind, wearer will feel lighter, free of burden when wearing a soft and elastic jacket made of the elastic weft knitted fabric and exercising, and it is possible for a person

wearing the elastic jacket to do aerobic exercise which is healthful.

Mode of Carrying out the Invention

[0018] The following examples are provided to give further explanation of the present invention.

Example 1:

[0019] 84 dtex /72 filament cationic dyeable PET yarns and 33 dtex polyurethane yarns were used in a proportion of 88 to 12 to produce a circular plain knit fabric with a gram weight of 175 g/m². A compression garment of size L using the knit fabric for 100% body circumference was finally made after the treatments of refining, dyeing, and forming. The weft knitted fabric was measured to have a maximal tightness index of 0.7 and a maximal recovery stress of 1.2 N at 30~80% elongation. A male subject having a body height of 173 cm, a body weight of 72 kg and monthly exercising at an amount of 120 Mets·hr did golf swing at a frequency of 30 times/min, and continued for 5 minutes in a mode of exercising for 1 min and then resting for 1 min. The maximal respiratory quotient of the male subject was measured with a cardio-pulmonary function tester from JAEGER Company of German during the exercising and it was 0.86. A contact pressure tester from AMI Company of Japan was used to measure the following maximal clothing pressures when wearing the elastic jacket in a motionless state: 0.57 kPa in a position between the elbow portion and the wrist portion, 0.33 kPa in the chest portion, and 0.39 kPa in the back side. The maximal clothing pressure in a motion state was 1.15 kPa at a position between the elbow portion and the wrist portion, 0.27 kPa in the chest portion, and 0.88 kPa in the back side. The color fastness of the elastic jacket dyed with cationic dyes was Class 4 or higher when measured according to JIS.

Example 2:

[0020] Core-sheath composite deformation textured yarns made of 110 dtex /51 filament polyamide and 33 dtex polyurethane yarns were used in a proportion of 90 to 10 to produce a circular plain knit fabric with a gram weight of 180 g/m². A compression garment of size L using the knit fabric for 100% body circumference was finally made after the treatments of refining, dyeing, and forming. The circular knitted fabric was measured to have a maximal tightness index of 0.7 and a maximal recovery stress of 1.1 N at 30~80% elongation. A male subject having a body height of 173 cm, a body weight of 75 kg and monthly exercising at an amount of 86 Mets·hr did jogging exercise at 8 km/hr for 20 min. The maximal respiratory quotient of the male subject was measured with a cardio-pulmonary function tester from JAEGER Company of German during the exercising and it was 1.02. A contact pressure tester from AMI Company of Japan was used to measure the following maximal clothing pressures when wearing the soft and elastic jacket in a motionless state: 0.60 kPa at a position between the elbow position and the wrist portion, 0.31 kPa in the chest portion, and 0.36 kPa in the back side. The maximal clothing pressure in a motion state was 1.25 kPa at a position between the elbow portion and the wrist portion, 0.32 kPa in the chest portion, and 1.51 kPa in the back side. The color fastness of the soft and elastic jacket dyed with cationic dyes was Class 4 or higher when measured according to JIS.

Example 3:

[0021] Core-sheath composite deformation textured yarns made of 140 dtex /70 filament PET fiber core and polyamide fiber sheath, and 33 dtex polyurethane yarns were used to in a proportion of 92 to 8 produce a circular plain knit fabric with a gram weight of 180 g/m². A compression garment of size L using the knit fabric for 80% body circumference was finally made after the treatments of refining, dyeing, and forming. The circular knitted fabric was measured to have a maximal tightness index of 0.8 and a maximal recovery stress of 1.3 N at 30~80% elongation. A female subject having a body height of 168 cm, a body weight of 60 kg and monthly exercising at an amount of 460 Mets·hr did upright push-ups exercise at a frequency of 30 times/min. The exercise mode was: Exercise: 1 min; rest: 1 min; Exercise: 2 min; rest: 1 min; Exercise: 3 min; rest: 1 min; Exercise: 4 min; rest: 1 min. The total time of the Exercise was 10 min. The maximal respiratory quotient of the female subject was measured with a cardio-pulmonary function tester from JAEGER Company of German during the exercising and it was 1.02. A contact pressure tester from AMI Company of Japan was used to measure the following maximal clothing pressures when wearing the soft and elastic jacket in a motionless state: 0.60 kPa at a position between the elbow portion and the wrist portion, 0.33 kPa in the chest portion, and 0.39 kPa in the back side. The maximal clothing pressure in a motion state was 1.13 kPa at a position between the elbow portion and the wrist portion, 0.43 kPa in the chest portion, and 1.68 kPa in the back side portion. The color fastness of the soft and elastic jacket dyed with cationic dyes was Class 4 or higher when measured according to JIS.

Claims

1. A soft and elastic jacket wherein no less than 70 percent of the body circumference of the soft and elastic jacket is composed of an elastic weft knitted fabric, when the soft and elastic jacket is in a motionless state without being worn, the elastic weft knitted fabric has a tightness index of not greater than 0.8 and a recovery stress of 0.3~1.3 N at an elongation range of 30~80%.
2. The soft and elastic jacket according to claim 1 wherein the respiratory quotient is not greater than 1.05 when a person wearing the soft and elastic jacket exercises at an intensity of less than 7 Mets and a body exercise amount of not greater than 25 Mets·hr for an exercise time of less than 6 hrs.
3. The soft and elastic jacket according to claim 1 wherein the soft and elastic jacket has a clothing pressure of 0.6 kPa or less in a motionless state, and 2.5 kPa or less in a motion state.
4. The soft and elastic jacket according to claim 3 wherein the clothing pressure in a motionless state is 0.60 kPa or less at a portion between the elbow portion and the wrist portion, 0.33 kPa or less at the chest portion, and 0.40 kPa or less at the back side.
5. The soft and elastic jacket according to claim 3 wherein the clothing pressure in a motion state is 1.25 kPa or less at a portion between the elbow portion and the wrist portion, 0.45 kPa or less at the chest portion, and 1.85 kPa or less at the back side.
6. The soft and elastic jacket according to claim 1 wherein the elastic weft knitted fabric is produced by knitting 5~15% weight of elastic yarns with the rest of non-elastic yarns, and has a basis weight of 140-200 g/m².
7. The soft and elastic jacket according to claim 6 wherein the elastic yarns are polyurethane fibers.
8. The soft and elastic jacket according to claim 6 or 7 wherein the non-elastic yarns are modified polyethylene terephthalate fibers and/or polyamide fibers.
9. The soft and elastic jacket according to claim 8 wherein the non-elastic yarns are cationic dyeable PET fibers.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2010/078433

A. CLASSIFICATION OF SUBJECT MATTER		See Extra Sheet
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC: A41D1, A41D7, A41D13, A41D31, A41B9, A41B17, A41C1, D04B1, D03D15, A63B21		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
CNPAT, WPI, EPODOC, CNKI elast+, weft, polyurethane, spandex, sport+, mobility, activity		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 10 Dec. 2010 (10.12.2010)		Date of mailing of the international search report 27 Jan. 2011 (27.01.2011)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451		Authorized officer WANG, Qiuyan Telephone No. (86-10)62084130

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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A41D 1/04 (2006.01) i
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A41D 31/00 (2006.01) i
D04B 1/18 (2006.01) i
D03D 15/08 (2006.01) i

REFERENCES CITED IN THE DESCRIPTION

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