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(54) EXERCISE EXPENDITURE MONITOR DEVICE AND METHOD

(76) Inventor: **Yu-Yu Chen**, Taipei (TW)

Correspondence Address:
ROSENBERG, KLEIN & LEE
3458 ELLICOTT CENTER DRIVE-SUITE 101
ELLICOTT CITY, MD 21043 (US)

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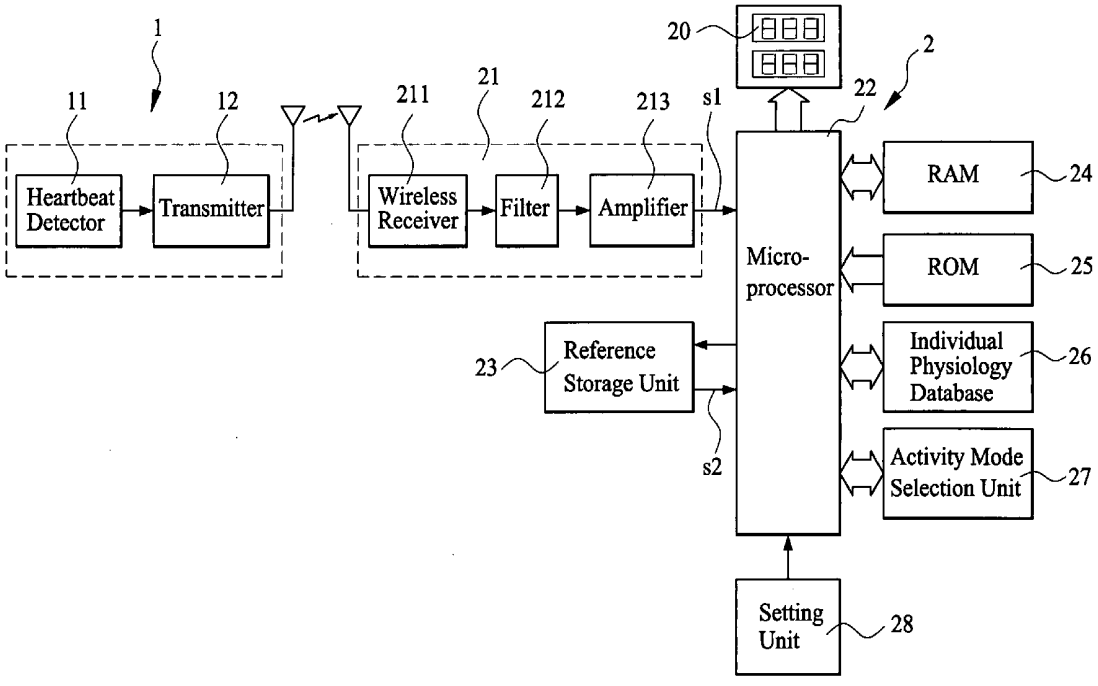
(57) **ABSTRACT**

An exercise expenditure monitor device and method for monitoring a user's caloric expenditure at exercise, the exercise expenditure monitor device including a heartbeat sensing device for detecting heart rate of the user, a reference storage unit for storing a standard heart rate and a reference heart rate of the user at rest mode, an individual physiology database for storing data of physiology weighted value and a set of individual physiological parameters inputted by the user including sex, age and weight, each set of individual physiological parameters corresponding to a physiology weighted value, a calculating unit which calculates a general caloric expenditure of the user according to an algorithm including dividing the heart rate difference between the exercise heart rate and the reference heart rate by the reference heart rate and multiplying by the physiology weighted value. Preferably, the exercise expenditure monitoring device includes an activity mode selection unit for storing data of activity weighted value and the item of activity that the user takes e.g. walking, jogging, running, jumping, cycling or aerobic dance. Each activity corresponds to an activity weighted value which is provided to the calculating unit which multiplies the general caloric expenditure by the activity weighted value and obtains a true caloric expenditure of the user.



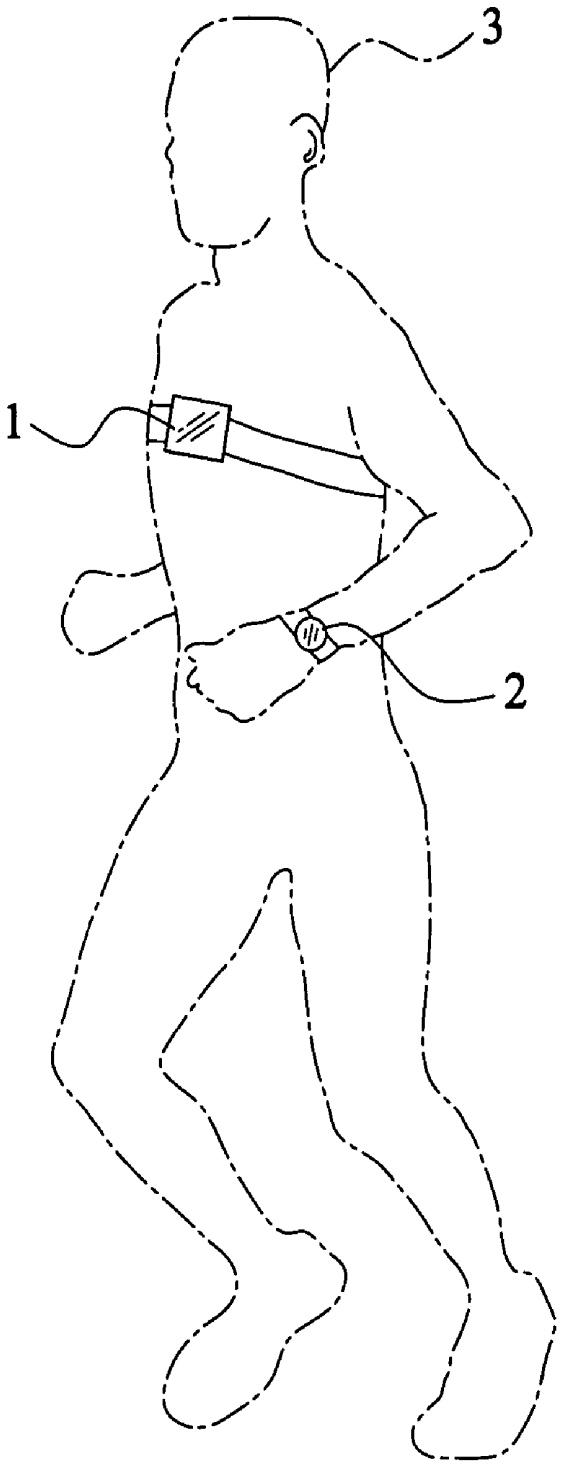


FIG.1

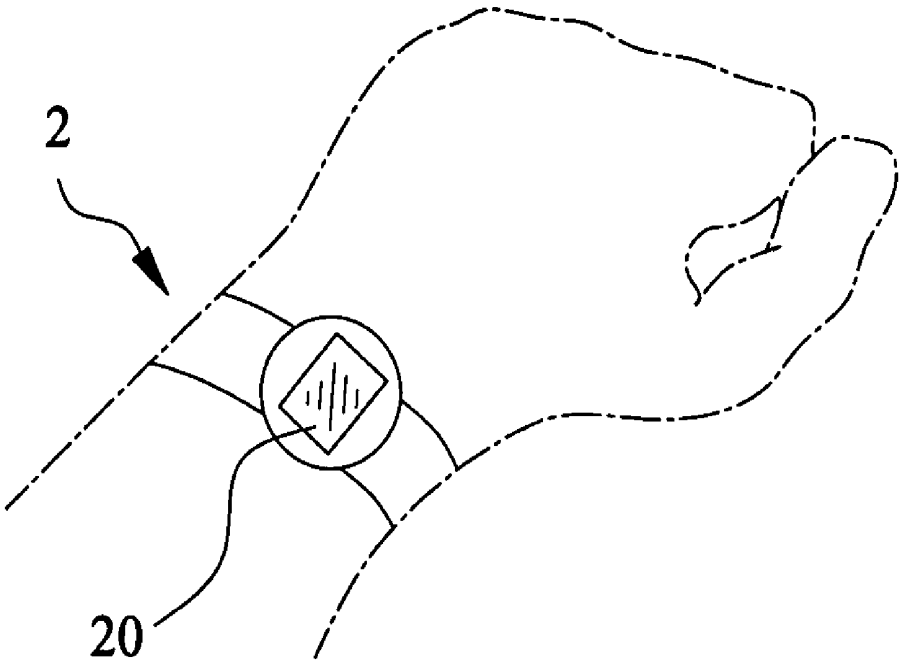


FIG.2

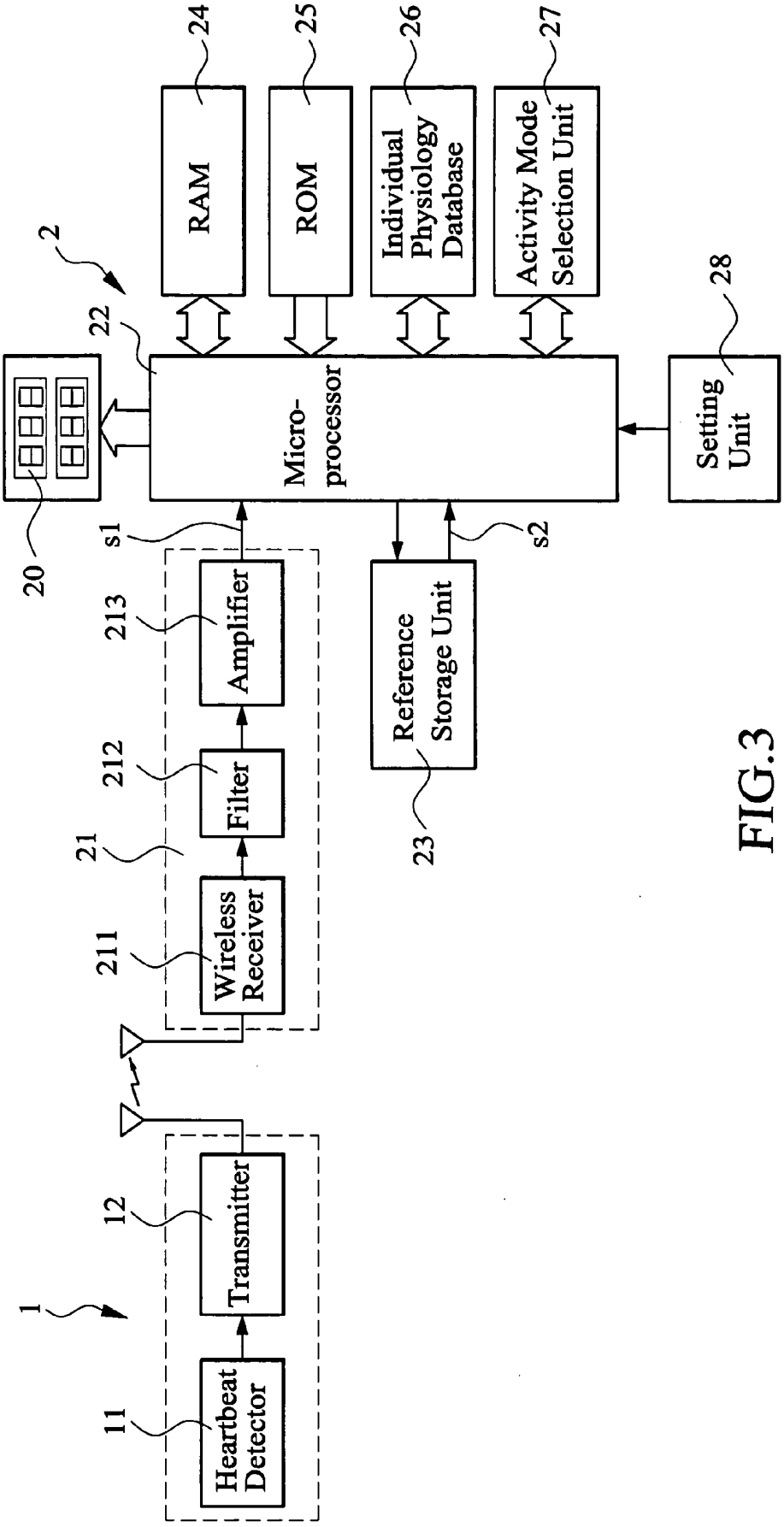

1
11
Heartbeat Detector
12
Transmitter
2
20
22
RAM
24
ROM
25
Individual Physiology Database
26
Activity Mode Selection Unit
27
28
Setting Unit
Micro-processor
s1
s2
21
211
Wireless Receiver
212
Filter
213
Amplifier
23
Reference Storage Unit

FIG.3

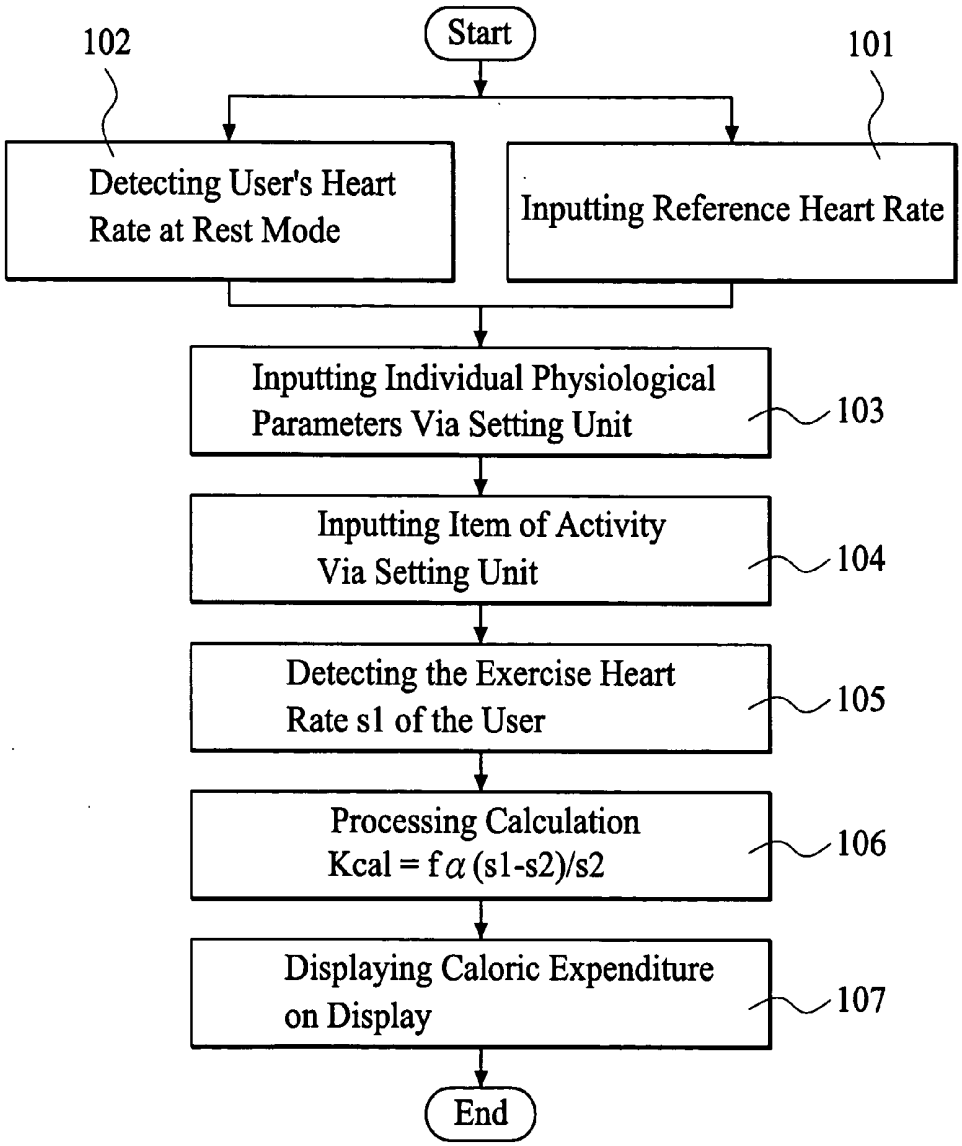

Start
102
101
Detecting User's Heart Rate at Rest Mode
Inputting Reference Heart Rate
Inputting Individual Physiological Parameters Via Setting Unit
103
Inputting Item of Activity Via Setting Unit
104
Detecting the Exercise Heart Rate s1 of the User
105
Processing Calculation Kcal = f α (s1-s2)/s2
106
Displaying Caloric Expenditure on Display
107
End

FIG.4

EXERCISE EXPENDITURE MONITOR DEVICE AND METHOD

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an exercise monitor, and more particularly to an exercise expenditure monitor device and method for monitoring a user's caloric expenditure at exercise.

[0003] 2. Description of the Prior Art

[0004] In the modern society, people have been living and working busily. They are inevitably always under substantial pressure. To relief pressure and for the sake of health, many people do exercise during spare time. Most people have their favorite sports and exercises. Some people prefer simple exercises like walking, jogging, running, jumping, hiking, and so on, and some people like to do exercise with exercise equipment.

[0005] Usually, when a user do exercise, he wants to measure and control the amount of exercise he takes. There are a variety of body building devices and exercisers in the market. However, the exercise equipment early developed can only provide simple functions for exercising, and are not capable to measure the amount of calorie that the user consumes. Hence, it is not easy for the exerciser to control an appropriate amount of exercise.

[0006] There are various types of body/motion signal sensing devices for a person to measure the amount of exercise taken and to monitor his personal physical conditions e.g. pedometer and heartbeat sensing device. However, most body signal sensing devices or motion signal sensing devices are only able to detect and indicate simple data. For example, a conventional pedometer can only measure the accumulated steps taken, and a conventional heartbeat sensing device can only detect the heartbeats of the user.

[0007] In U.S. Pat. No. 5,491,474, a telemetric transmitter unit is disclosed. The transmitter electronics is coupled to each electrode by means of a conductive plastic layer for transmission of signal. In U.S. Pat. No. 4,513,753, a heartbeat rate indicator in the form of a wristwatch is disclosed. Moreover, U.S. Pat. No. 5,622,180 describes a device for measuring heartbeat rate that includes a wrist strap with skin contact electrodes and a coil receiver for receiving telemetrically transmitted heartbeat signals either from a wireless receiver or from the skin contact electrodes.

[0008] Also, U.S. Pat. Nos. 4,371,945 and 5,164,967 disclose a pedometer for calculating a distance which a user walks, jogs or runs by electronically measuring the length of each stride taken by the use.

[0009] All of the aforesaid conventional body signal sensing devices and motion signal sensing devices are designed to have only one detecting and sensing function. That is, in practical use of these conventional sensing devices, they can detect and display only one type of signal. Body signal, for example heartbeat rate, if it is evaluated together with the exercise intensity, exercise type or exercise parameter, it is very useful and beneficial for athletes and sports fans. In fact, most of the products in market do not match the requirements in practical way.

[0010] Some producers have devoted to develop a few body signal sensing devices with multiple functions. Take for an example. U.S. Pat. No. 5,891,042 discloses a fitness monitoring device that includes an electronic pedometer which responds to a user's body motion at each step and a wireless heart rate monitor which is wirelessly coupled to the electronic pedometer. The pedometer is fitted to the user's waist and the wireless heartbeat monitoring device is fitted to the user's chest. The heartbeat signal is transmitted wirelessly to and is displayed on the pedometer. Practically, it is not easy and inconvenient for the user to view the data displayed on the pedometer.

[0011] Also, exercise monitors with calculating unit are known. Such exercise monitors are improved with expanded functions and are capable to measure the quantity of exercise. U.S. Pat. No. 6,605,044 discloses a caloric exercise monitor that is able to display either or both the calories remaining to be expended to reach the entered goal or the remaining exercise time required to reach the entered goal on a display. However, the calorie exercise monitoring device is not practical.

SUMMARY OF THE INVENTION

[0012] Thus, a primary object of the present invention is to provide an exercise expenditure monitor device capable of providing a caloric expenditure of a user at exercise based on the user's heart rate detected.

[0013] Another object of the present invention is to provide an exercise expenditure monitor device capable of providing the caloric expenditure of the user at exercise based on his individual physiological parameters e.g. age, sex and weight and the item of activity that the user performs.

[0014] A further object of the invention is to provide an exercise expenditure monitor method which can calculate the user's caloric expenditure from the heart rate difference between exercise heart rate and reference heart rate at rest mode, the individual physiological parameters and the item of activity that the user performs.

[0015] To achieve the above and other objects, in accordance with the present invention, there is provided with an exercise expenditure monitor device and a method for monitoring a user's caloric expenditure at exercise. The exercise expenditure monitor device includes a heartbeat sensing device for detecting at least a heart rate of the user at exercise, a reference storage unit for storing a standard heart rate and a reference heart rate of the user at rest mode, an individual physiology database for storing a data of physiology weighted values and a set of individual physiological parameters inputted by the user including sex, age and weight, each set of individual physiological parameters corresponding to a physiology weighted value, a calculating unit which calculates a general caloric expenditure of the user according to an algorithm including dividing the heart rate difference between the exercise heart rate and the reference heart rate by the reference heart rate and multiplying by the physiology weighted value.

[0016] Preferably, the exercise expenditure monitoring device further includes an activity mode selection unit for storing data of activity weighted values and the item of activity that the user takes e.g. walking, jogging, running,

jumping, cycling or aerobic dance. Each activity corresponds to an activity weighted value which is provided to the calculating unit that further multiplies the general caloric expenditure by the activity weighted value and obtains a true caloric expenditure of the user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The present invention will be apparent to those skilled in the art by reading the following description of the best mode and a preferred embodiment of a device for carrying out the present invention, with reference to the attached drawings, in which:

[0018] **FIG. 1** is a perspective view showing that an exercise expenditure monitor device constructed according to the present invention is fitted to a user;

[0019] **FIG. 2** is perspective view showing that a monitoring device of the exercise expenditure monitor device is fitted to a wrist of the user;

[0020] **FIG. 3** is a block diagram showing a control circuit of the exercise expenditure monitor device in accordance with a preferred embodiment of the present invention; and

[0021] **FIG. 4** is a flow chart showing the steps performed during the application of the exercise expenditure monitor device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] With reference to the drawings and in particular to **FIG. 1** which is a perspective view showing that an exercise expenditure monitor device of the present invention is fitted to a user. The exercise expenditure monitor device of the present invention comprises a wireless heartbeat sensing device **1** and a monitoring device **2**. Please also refer to **FIG. 2**. The wireless heartbeat sensing device **1** is fitted to a chest of the user **3** for detecting at least a heart rate of the user, and the monitoring device **2** is fitted to a wrist of the user for displaying. It should be understood that the monitoring device may be positioned on any place e.g. on an exercise equipment that is convenient for the user to view and is not limited to be put on the wrist of the user.

[0023] As shown in **FIG. 3** which is a block diagram of a control circuit of the exercise expenditure monitor device in accordance with a preferred embodiment of the invention, the wireless heartbeat sensing device **1** comprises a heartbeat detector **11** and a wireless transmitter **12**. The heartbeat detector **11** detects a heart rate of the user and forwards a heartbeat signal to the wireless transmitter **12** which transmits the heartbeat signal wirelessly.

[0024] The monitoring device **2** comprises a wireless receiving circuit **21** for receiving the heartbeat signal transmitted by the wireless heartbeat sensing device **1**. The wireless receiving circuit **21** comprises a wireless receiver **211** for receiving the heartbeat signal wirelessly and transmitting the heartbeat signal to a filter **212** for filtering the noise. The filtered heartbeat signal is then transmitted to an amplifier **213** for amplifying. Subsequently, the amplified heartbeat signal **s1** is transmitted to a calculating unit for calculating and processing. The calculating unit may be comprised of a microprocessor **22**.

[0025] The microprocessor **22** is connected with a reference storage unit **23** which stores and provides a reference heart rate **s2** to the microprocessor **22**. The reference heart rate **s2** can be either a standard heart rate or a resting heart rate of the user. The user's resting heart rate is either inputted by the user or provided by the heartbeat sensing device **1** which detects the heart rate of the user at rest status and transmits the heartbeat signal wirelessly via the wireless receiving circuit **21** to the reference storage unit **23** for storing.

[0026] The microprocessor **22** is coupled to a random access memory (RAM) **24** and a read only memory (ROM) **25**. The RAM **24** comprises a memory for temporary storage of data for the microprocessor during operation of the exercise expenditure monitor device. The ROM **25** stores the operation program of the exercise expenditure monitor device.

[0027] The microprocessor **22** is also coupled with an individual physiology database **26** which stores the individual physiological parameters of the user including sex, age, weight and so on. The individual physiology database **26** also stores a data of physiology weighted value α. Each set of the individual physiological parameters corresponds to a physiology weighted value α which is a conversion factor for converting the caloric expenditure from the heart rate.

[0028] Moreover, the microprocessor **22** is connected with an activity mode selection unit **27** which stores a data of activity weighted values f and the item of activity inputted by the user. Each activity corresponds to an activity weighted value f. The activity may include walking, jogging, jumping, running, aerobic dance, cycling, and so on.

[0029] A setting unit **28** is connected to the microprocessor **22** for inputting data or parameters. The data or parameters may include the reference heart rate, individual physiological parameters and the item of activity, that are then forwarded to the reference storage unit **23**, the individual physiology database **26** and the activity mode selection unit **27**.

[0030] Please refer to **FIGS. 3 and 4**. **FIG. 4** is a flowchart showing the steps performed during the application of the exercise expenditure monitor device. Firstly, the user inputs the reference heart rate via the setting unit **28**. The reference heart rate is the resting heart rate of the user known by the user (step **101**) or detected by the heartbeat sensing device **1** at rest mode (step **102**). The reference heart rate is stored in the reference storage unit **23**, so that the reference storage unit **23** may supply the reference heart rate **s2** to the microprocessor **22**.

[0031] In the case when the exercise expenditure monitor device does not get the reference heart rate from the user, the reference storage unit **23** provides a standard reference heart rate **s2** to the microprocessor **22**.

[0032] In step **103**, the user inputs his individual physiological parameters via the setting unit **28**. The individual physiological parameters include sex, age, and weight that are stored in the individual physiology database **26**. The individual physiology database **26** provides a physiology weight value α corresponding to the setting of individual physiological parameters. The physiology weighted value α is a conversion factor for converting the caloric expenditure from the heart rate for an individual possessing the physiological characteristics.

[0033] In step **104**, the user inputs the item of activity that he performs via the setting unit **28**, e.g. walking, jogging, jumping, running or aerobic dance. The item of activity is stored in the activity mode selection unit **27**. The activity mode selection unit **27** provides an activity weighted value f corresponding to the activity.

[0034] The user starts to exercise after the aforesaid steps. The heartbeat sensing device **1** detects the exercise heart rate s**1** of the user in step **105**. The exercise heart rate s**1** is transmitted via the receiving circuit **21** to the microprocessor **22**. In step **106**, the microprocessor **22** processes calculation. First, a heart rate difference is obtained by subtracting the reference heart rate s**2** from the exercise heart rate s**1**, i.e. (s**1**−s**2**). The heart rate difference (s**1**−s**2**) is divided by the reference heart rate s**2** and multiplied by the physiology weighted value α and the activity weighted value f. The value resulted from the calculation is the caloric expenditure of the user. The caloric expenditure represents the energy in Kcal that the user is expended at taking the activity. In other words,

$$\text{Caloric expenditure } (Kcal) = fa(s1-s2)/s2$$

[0035] The caloric expenditure is displayed on the display **20** of the monitoring device **2** (step **107**). Practically, it is quite simple for the user to use the exercise expenditure monitor device. He just has to fasten the monitoring device **2** on his wrist and fit the heartbeat sensing device **1** to his chest. When the user exercises, the heartbeat sensing device **1** detects his heart rate at exercise, and then the microprocessor processes and calculates. He can easily monitor his caloric expenditure from the display **20** on the monitoring device **2**. Accordingly, he can stop exercise when he has consumed an appropriate amount of energy.

[0036] Although the present invention has been described with reference to the preferred embodiments thereof, it is apparent to those skilled in the art that a variety of modifications and changes may be made without departing from the scope of the present invention which is intended to be defined by the appended claims.

What is claimed is:

1. An exercise expenditure monitor device for measuring a caloric expenditure of a user comprising:

a heartbeat sensing device for detecting at least a heart rate of the user at exercise;

a reference storage unit for storing a reference heart rate of the user before doing exercise;

an individual physiology database for storing a data of physiology weighted value and a set of individual physiological parameters inputted by the user including sex, age and weight, in which one set of personal physiological parameters corresponds to a physiology weighted value which is a conversion factor for converting caloric expenditure from the heart rate;

a calculating unit for processing and calculating a general caloric expenditure of the user according to an algorithm which includes dividing the heart rate difference between the exercise heart rate and the reference heart rate by the reference heart rate and multiplying by the physiology weighted value; and

a display for displaying the caloric expenditure calculated by the calculating unit.

2. The exercise expenditure monitor device as claimed in claim 1, further comprising an activity mode selection unit which stores a data of activity weighted values and the item of activity inputted by the user, in which each activity corresponds to an activity weighted value, and the calculating unit further multiplies the general caloric expenditure by the activity weighted value, making a true caloric expenditure.

3. The exercise expenditure monitor device as claimed in claim 2, wherein the items of activity include walking, jogging, running, jumping, hiking, aerobic dance and cycling.

4. The exercise expenditure monitor device as claimed in claim 1, wherein the display further displays the exercise heart rate of the user.

5. The exercise expenditure monitor device as claimed in claim 1, wherein the display further displays the individual physiological parameters inputted by the user including sex, age and weight.

6. The exercise expenditure monitor device as claimed in claim 1, wherein the heartbeat sensing device is a wireless heartbeat sensing device which is fitted to the chest of the user for detecting the heart rate of the user.

7. The exercise expenditure monitor device as claimed in claim 1, wherein the monitoring device comprises a monitor for fastening to the wrist of the user.

8. A method for monitoring a caloric expenditure of a user during exercise, comprising the steps of:

(a) inputting a reference heart rate;

(b) inputting a set of individual physiological parameters of the user including sex, age and weight;

(c) detecting the exercise heart rate of the user at exercise;

(d) calculating a heart rate difference by subtracting the reference heart rate from the exercise heart rate;

(e) dividing the heart rate difference by the reference heart rate and multiplying by a physiology weighted value, getting a general caloric expenditure of the user; and

(f) displaying the caloric expenditure.

9. The method as claimed in claim 8, wherein the reference heart rate of step (a) is a standard heart rate.

10. The method as claimed in claim 8, wherein the reference heart rate of step (a) is a resting heart rate of the user inputted by the user.

11. The method as claimed in claim 8, wherein the reference heart rate of step (a) is a heart rate of the user at rest mode detected by the heartbeat sensing device.

12. The method as claimed in claim 8, further comprising a step of inputting an item of activity that the user takes after step (b), each activity corresponding to an activity weighted value which is incorporated in the calculation algorithm by multiplying the general caloric expenditure by the activity weighted value and making a true caloric expenditure of the user.

* * * * *

专利名称(译)	运动支出监测装置和方法		
公开(公告)号	US20050148827A1	公开(公告)日	2005-07-07
申请号	US10/747356	申请日	2003-12-30
[标]申请(专利权)人(译)	陈俞		
申请(专利权)人(译)	陈钰瑜		
当前申请(专利权)人(译)	陈钰瑜		
[标]发明人	CHEN YU YU		
发明人	CHEN, YU-YU		
IPC分类号	A61B5/024 A61B5/22 A61B5/00 A61B5/02		
CPC分类号	A61B5/02438 A61B5/6831 A61B5/222		
其他公开文献	US7229416		
外部链接	Espacenet USPTO		

摘要(译)

一种用于监测用户在运动时的卡路里消耗的运动支出监测装置和方法，所述运动支出监测装置包括用于检测用户心率的心跳感测装置，用于存储标准心率的参考存储单元和参考心率用户处于休息模式，用于存储生理加权值数据的个体生理数据库和用户输入的一组个体生理参数，包括性别，年龄和体重，每组生理参数对应的生理加权值，计算根据算法计算用户的一般热量消耗的单元，该算法包括将运动心率和参考心率之间的心率差除以参考心率并乘以生理加权值。优选地，运动费用监测装置包括活动模式选择单元，用于存储活动加权值的数据和用户采取的活动项目。散步，慢跑，跑步，跳跃，骑自行车或有氧舞蹈。每个活动对应于活动加权值，该活动加权值被提供给计算单元，该计算单元将一般卡路里消耗乘以活动加权值并获得用户的真实卡路里消耗。