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33 **Sources of support**

34 Grant provided by P. Carl Petersen Fond, Stipend from RegionH.

35

36 **Word count**

37 1200 word excluding references.

38

39 **Conflict of interest declaration**

40 None of the authors declared any conflict of interest.

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46 **Rejuvenation of the term Sarcopenia**

47 It is our viewpoint that the recent consensus definitions of Sarcopenia are dysfunctional for clinical and
48 experimental practice as well as in theory. In 1989 the term Sarcopenia was introduced to describe the
49 phenomenon of age related loss of lean body mass(10). Since 2010 six consensus definitions have been
50 presented, and in 2016 it was assigned its own ICD-10 code(1, 3, 5, 6, 8, 9, 11). A comparison of the
51 original definition with the new consensus definitions clarifies how the term Sarcopenia no longer describes
52 the phenomenon it originally addressed. Rather, the term is now caught in tautological association, which
53 causes confusion and hinders rather than helps understanding of this condition.

54 **The original definition**

55 In 1989, Rosenberg observed that the phenomenon of decreasing lean body mass with older age had not been
56 given the scientific attention it deserved, and drew attention to it, in suggesting a name combining the two
57 words *sarco* (meaning flesh) and *penia* (meaning loss), in accordance with the characteristic that it
58 described(10). The focus of this original definition was the loss of muscle mass as a discrete phenomenon,
59 with a leading interest in legitimizing clinical and scientific attention to it(10). This definition of Sarcopenia
60 was used descriptively with the purpose of defining and articulating the loss of skeletal muscle mass, as a
61 concrete object.

62 **The new consensus definitions**

63 Between 2011 and 2014, six consensus definitions of Sarcopenia were agreed (3, 5, 6, 8, 9, 11). These
64 shifted the focus from the original phenomenon of loss of skeletal muscle mass to that of physical function.
65 All of these definitions employ an algorithm with the same logic. Physical function capability is initially
66 assessed (gait speed or grip strength), and only if function is impaired below a cut-point, is muscle mass (as
67 the appendicular lean mass (ALM)) secondarily evaluated. Hence, low muscle mass is not a single stand-
68 alone determinant by which Sarcopenia is defined, and having only a low muscle mass is not an adequate
69 criterion by which to be defined as being Sarcopenic. Physical function is not synonymous with muscle
70 function although the concepts are sometimes used interchangeable in the six consensus articles. Physical

71 function is an interplay between multiple organ systems that can be estimated through tests like gait speed
72 whereas skeletal muscle, besides having the capability of contracting and allowing movement, has many
73 functions in metabolism and as an endocrine organ.
74 The consensus definitions were made by working groups, with representatives from different Societies
75 within the geriatric field, in Europe, the United States and Asia, two of them receiving partial funding from
76 the pharmaceutical industry. Discussion surrounding these definitions focusses most strongly on
77 determination of the exact cut-off values for both physical function tests and muscle mass measurements.
78 Surprisingly, the theoretical framework underpinning the definitions is not discussed thoroughly in any of the
79 articles and arguments for the inclusion of physical function is found in only three(5, 8, 11) of the six
80 papers. They share one main argument only, that the original definition is not clinically relevant.

81

82 **Questioning the reasoning for changing the definition**

83 The main argument for including physical function in the definition is at least two-fold. Firstly, if a well-
84 defined phenomenon is not clinically relevant, changing the definition does not make it become clinically
85 relevant. Instead, it changes the phenomenon under consideration. Secondly, every definition can become
86 clinically relevant by adding a criterion that is clinically relevant, as in this case with physical function. The
87 linking of loss of skeletal muscle mass to physical function reflects the logic behind the change of focus in
88 the research field of sarcopenia, which is notably absent from the consensus articles. During the 1990s there
89 was a research drive to develop operational criteria for cutoff values for categorizing adults as suffering from
90 Sarcopenia. The initial suggestion for an operational criterion and cutoff value was established by
91 Baumgartner in 1998, who legitimized the criterion by showing its association with a decrease in physical
92 function and mortality(2). This initiated the shift in focus from muscle mass to physical function. From
93 around 2000, the research focus shifted to considerations of how muscle strength and physical function such
94 as gait speed have stronger association than low muscle mass to a decrease in physical function and
95 mortality. Instead of concentrating on the loss of muscle mass, research interest centered on the robustness of
96 the phenomenon's association with decreased physical function and mortality, thereby making physical
97 function the primary object of interest.

98

99 From a clinical perspective it appears reasonable to focus on the phenomenon with the strongest association
100 to a negative health outcome. However, in this case the outcome and the phenomenon is almost, if not
101 exactly, identical, and the argument for the change of focus from muscle mass to physical function is a
102 tautology – arguing that there should be a change in focus from decreased muscle mass to decreased physical
103 function, since a decrease in physical function has a stronger association with a decrease in physical
104 function.

105

106 There are several consequences of the change in definition. According to the algorithms used in the
107 consensus definitions, skeletal muscle is only of value to the definitions if it is associated with bodily
108 movement. If gait speed is not reduced, presence of a low muscle mass is irrelevant according to the
109 consensus definitions. This is despite the fact that skeletal muscle is the largest metabolic organ of the body,
110 and is crucial in the endocrine regulation of metabolism as well as being the body's largest reservoir of
111 amino acids(7). Such functions are likely to be overlooked clinically when the primary inclusion criterion for
112 sarcopenia is physical function and not muscle mass. Likewise, physical function is at risk of being reduced
113 to the question of muscle mass when both are directly coupled in the definition(4). Further, it reduces the
114 relevance of the term in other clinical specialties such as nephrology and endocrinology, where muscle mass
115 per se could be of clinical importance for both categorizing patients as well as in selecting treatment. Beside
116 the reductionist understanding of the two different phenomena, the new definitions also lead to general
117 confusion of what is meant by the term Sarcopenia, since it no longer covers one but two phenomena.

118

119 **Conclusion**

120 Since the reasoning behind the change in definition of sarcopenia rests upon a tautological association, and
121 that the meaning of the term has become misleading as it no longer corresponds with the phenomenon that it
122 addresses, we suggest a return to the use of the original definition for future research. 'Sarcopenia' should
123 exclusively be used as a descriptive term addressing age-related loss of muscle mass. This would return
124 focus onto uncovering the causes and consequences of the phenomenon, and clinicians will hereby have an

125 unambiguous and useful term. Perhaps returning to the original definition could cause confusion in relation
126 to acceptance of age related loss of muscle mass as a clinical relevant phenomenon. However, the theoretical
127 foundations of the consensus definitions are tautological, and we anticipate that the consequences of these
128 definitions would continue to create confusion. There may be other and better definitions than the original
129 but since nobody will benefit from the current consensus definitions, breaking out of the tautology is
130 necessary to allow science and clinical practice to move on.

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