

1 **Associations between physical activity patterns and quality of life in persons with type 2**
2 **diabetes: A cross sectional study**

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33 **“This is an Accepted Manuscript of an article published by PLOS Production in PLOS**
34 **ONE on 30/08/2023, available online: <https://doi.org/10.1371/journal.pone.0290825>**

35 **Abstract**

36 **Background**

37 Type 2 diabetes is a major health problem globally and particularly in Ghana. Regular physical
38 activity is important in the management of type 2 diabetes and in improving quality of life of
39 persons with type 2 diabetes. However, there is a lack of data reporting on how physical activity
40 relate to quality of life in persons with diabetes in Ghana. This study explored how physical
41 activity patterns relate to quality of life in persons with type 2 diabetes from a major tertiary
42 hospital in Ghana.

43 **Methods**

44 One hundred and twenty-one (121) persons with type 2 diabetes (age, 30 – 60 years) filled in
45 questionnaires on their physical activity patterns (time spent in sitting, walking, moderate-
46 intensity activities, and vigorous-intensity activities) and quality of life (diabetes control, anxiety
47 and worry, social burden, sexual functioning, energy and mobility). The relationships between
48 the variables were examined using spearman correlation.

49 **Results**

50 Time spent in sitting, walking, moderate-intensity activities and vigorous-intensity activities were
51 1677.7±401.5min, 464.1±296.0MET-min, 241.2±65.8MET-min and 1956.5±1251.0MET-min
52 respectively. Walking was negatively related to energy and mobility ($r=-.48$, $p<0.01$), sexual
53 functioning ($r=-0.44$, $p<0.01$), social burden ($r=-0.41$, $p<0.01$) and diabetes control ($r=-0.56$,
54 $p<0.01$) domains of quality of life. Vigorous-intensity activities was negatively related to anxiety
55 and worry ($r=-0.20$, $p<0.05$).

56 **Conclusions**

57 The results suggests that persons with type 2 diabetes who experience decline in energy and
58 mobility, sexual functioning, and disease management, and heightened social burden, anxiety
59 and worry may benefit from guidance on optimal physical activity behaviour in the form of
60 walking to improve their quality of life.

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63 **Introduction**

64 Type 2 diabetes is a major public health issue globally [1]. In Ghana, the prevalence of type 2
65 diabetes has been increasing, with an estimated 7% of the adult population affected by type 2
66 diabetes [2-4]. However, there are even many cases which are undiagnosed due to numerous
67 factors including but not limited to unavailability of resources for detection and diagnosis [4-6].
68 Equally, type 2 diabetes associated morbidity and mortality has been increasing appreciably in
69 recent years [1,7-9].

70 Lower quality of life has been observed in persons with type 2 diabetes compared to persons
71 without diabetes [10]. Reducing the burden of type 2 diabetes is therefore an important public
72 health priority globally and particularly across countries in Africa, the geographical region with
73 the highest type 2 diabetes associated morbidity and mortality [7-9,11]. Despite ongoing
74 activities to improve management of type 2 diabetes, more needs to be done considering the
75 high and growing burden of the condition [7].

76 Lifestyle changes are recommended to reduce the burden of type 2 diabetes. Consequently, the
77 adoption and maintenance of physical activity together with decreasing sedentary time is
78 essential for type 2 diabetes management and overall health in persons with diabetes [12,13].
79 Physical activity improves blood glucose control and quality of life, reduces cardiovascular risk
80 and mortality in persons with type 2 diabetes, and prevent or delay onset of type 2 diabetes [14-
81 20].

82 Despite the growing burden of type 2 diabetes and the known beneficial effects of physical
83 activity, studies exploring physical activity behaviour and how it relates to quality of life in persons
84 with type 2 diabetes in Ghana are scarce. Understanding this relation can help guide and tailor
85 management for persons with type 2 diabetes and promote an active lifestyle in this population
86 to reduce their disease burden.

87 Therefore, the aim of this study was to examine reported time in physical activity forms and how
88 these relate to quality of life in persons with type 2 diabetes attending a major tertiary hospital in
89 Ghana. We hypothesized that time spent in sitting would be associated with a decrease in quality

90 of life, and time spent in walking, moderate-intensity activities and vigorous-intensity activities
91 would be associated with an increase in quality of life.

92 **Materials and methods**

93 This was a cross-sectional study design where participants reported time spent in sitting,
94 walking, moderate-intensity activities and vigorous-intensity activities, and their quality of life. All
95 study procedures were approved by the Research Ethics Committee of the University of Health
96 and Allied Sciences [reference: UHAS-REC A.9 (104) 20-21].

97 Participants were persons with type 2 diabetes recruited from the Diabetes Clinic, Ho Teaching
98 Hospital, located within the Ho Municipality of the Volta Region in Ghana. The Diabetes Clinic
99 provides medical care for people with diabetes in the entire region. Participants were recruited
100 through public advertisement (social media, posters and word of mouth) between May 2021 to
101 July 2021.

102 Those interested in participation were contacted by the researchers who explained the study
103 rationale, potential benefits, procedures, and answered all questions. Written informed consent
104 was obtained from eligible and willing participants. Criteria for inclusion were people 18 years
105 and older, diagnosed with diabetes for a year or more and ambulatory (with or without assistive
106 device). Participants were excluded from the study if they were not able to complete the
107 questionnaires even with help or had comorbid conditions that may influence understanding or
108 answering of the questionnaires.

109 Enrolled participants were assessed through standardised measurements obtained from a clinic
110 visit. During the visit, demographic data, including age, sex, educational status, marital status,
111 duration of illness (years since diagnosis) and medical treatment were first collected. Afterwards,
112 participants completed a set of questionnaires: a self-report questionnaire on their physical
113 activity [20] and diabetes-related quality of life [21]. Further details of these measures provided
114 below. To prevent questionnaire order and administration biases, participants completed the
115 questionnaires in random order [22].

116 An a priori sample size calculation was performed using the Roasoft online sample size
117 calculator (Roasoft Inc, 2004, <http://www.raosoft.com/samplesize.html>), using the average

118 monthly attendance of persons with diabetes at the study site which was 60 [23]. At 95%
119 confidence level, 5% margin of error, and a response distribution of 50%, an estimated sample
120 size of 92 participants was required.

121 Physical activity levels were assessed using the short version of the International Physical
122 Activity Questionnaire (IPAQ-SF). The original IPAQ was developed as an instrument for cross
123 national monitoring of physical activity and inactivity across diverse countries and populations
124 [20]. The IPAQ has been shown to be a reliable and valid tool to assess physical activity [20].
125 The IPAQ-SF contains 7 items and assesses the frequency (days) and duration (minutes and/or
126 hours) of sitting, walking, moderate- and vigorous-intensity activities. Total minutes for each
127 activity was computed by multiplying the frequency by the duration. A Metabolic equivalent
128 (MET)-minute was computed for walking, moderate and vigorous activities by multiplying the
129 MET score by the activity duration (minute). One MET is defined as the resting metabolic rate.
130 The following values were used for scoring: walking \times 3.3 METs, moderate physical activity \times
131 4.0 METs, vigorous physical activity \times 8.0 METs [20].

132 Diabetes-related quality of life was assessed using the Diabetes-39 (D-39) Questionnaire. The
133 D-39 is specific to types 2 diabetes and contains five dimensions: energy and mobility (15 items),
134 diabetes control (12 items), anxiety and worry (4 items), social burden (5 items), and sexual
135 functioning (3 items) [21]. The D-39 is a valid discriminative instrument and has been shown to
136 significantly correlate with overall quality of life, pattern of diabetes severity, and comorbidity
137 [21]. The score for each item ranged from 1 (not affected at all) to 7 (extremely affected). The
138 possible score for all dimensions ranges from 39 to 273, with a low score indicating better quality
139 of life [21].

140 **Data analysis**

141 Data were analysed using IBM Statistical Package for the Social Sciences version 23.0 [24].
142 Based on descriptive statistic and visual inspection of frequency distributions, data were non-
143 normally distributed. All values were reported using descriptive statistics of means, standard
144 deviations and ranges to summarize characteristics of participants. Associations between time

145 spent in sitting, walking, moderate-intensity activities and vigorous-intensity activities, and
146 quality of life domains were examined using spearman correlations coefficients.

147 **Results**

148 Response rate was 100%. Descriptive statistics of the study sample and outcome measures
149 are presented in Table 1. Of the 121 participants (age = 30-60 years), majority were female
150 (72%), aged 41-50 years (44.6%), had tertiary education (28.1%) and were married (82.6%).

151 More than half of the respondents were employed (52.9%), had been living with the condition
152 between 5-10 years (56.2%) and were on Metformin (82.6%).

153 Averagely, the participants spent 1677.7 ± 401.5 min in sitting, 464.1 ± 296.0 MET-min in
154 walking, 241.2 ± 65.8 MET-min in moderate-intensity activities and 1956.5 ± 1251.0 MET/min
155 in vigorous-intensity activities. Overall quality of life was 194.3 ± 42.9 .

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Table 1: Demographic and physical characteristics of the study participants (N = 121)

Variable	N (%) or Mean \pm SD
Age category	
≤ 30	14 (11.6)
31-40	22 (18.2)
41-50	54 (44.6)
51-60	31 (25.6)
Gender	
Male	34 (28)
Female	87 (72)
Educational status	
Tertiary	34 (28.1)
Senior secondary	23 (19.0)
Junior secondary	18 (14.9)
Primary	26 (21.5)
No education	20 (16.5)
Marital status	
Single	21 (17.4)
Married	100 (82.6)
Employment status	
Employed	64 (52.9)
Unemployed	57 (47.1)
Diabetes duration	
<5 years	32 (26.5)
5-10 years	68 (56.2)
11-15 years	16 (13.2)
≥ 16	5 (4.1)
Type of diabetes medication	
Insulin	13 (10.7)
Metformin	100 (82.7)
Others	8 (6.6)
Physical Activity	
Sitting (minutes)	1677.7 \pm 401.5
Walking (MET-minutes)	464.1 \pm 296.0
Moderate activities (MET-minutes)	241.2 \pm 65.8
Vigorous activities (MET-minutes)	1956.5 \pm 1251.0
Quality of life	
Energy and Mobility	39.7 \pm 22.2
Diabetes Control	32.5 \pm 18.5
Anxiety and Worry	10.5 \pm 5.8
Social Burden	12.1 \pm 9.4
Sexual Function	8.2 \pm 6.6

Associations between physical activity and quality of life domains

Results from the associations between physical activity patterns and quality of life domains

are presented in Table 2. The results revealed a statistically significant negative moderate

associations between walking and energy and mobility ($r = -.48$, $p < 0.01$), sexual functioning

193 (r=-0.44, p<0.01), social burden (r=-0.41, p<0.01) and diabetes control (r=-0.56, p<0.01). In
 194 other words, walking was associated with better energy and mobility, sexual functioning,
 195 diabetes control and reduced social burden.

196 A significantly weak negative association was also found between vigorous-intensity activities
 197 and anxiety and worry (r=-0.20, p<0.05). In other words, vigorous-intensity activities were
 198 associated with less anxiety and worry.

199 No associations were found between sitting and all quality of life domains (p>0.05), and
 200 between moderate activity and all quality of life domains (p>0.05).

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202 **Table 2: Spearman correlations of physical activity and quality of life domains**

	Energy and mobility	Diabetes control	Anxiety and worry	Social burden	Sexual functioning
Sitting	-0.05	-0.01	-0.16	0.02	-0.04
Walking	-0.48*	-0.56*	-0.16	-0.41*	-0.44*
Moderate activities	-0.12	-0.09	-0.06	-0.15	-0.07
Vigorous activities	-0.14	-0.16	-0.20*	-0.10	-0.14

203 * Correlation Is Significant at p<0.05

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205 **Discussion**

206 This study investigated the associations between reported physical activity patterns (sitting,
 207 walking, moderate and vigorous activity) and quality of life domains in persons with type 2
 208 diabetes attending a tertiary hospital in Ghana and found modest negative associations between
 209 walking and energy and mobility, sexual functioning, social burden, and diabetes control. In
 210 other words, increased self-reported walking was associated with better energy and mobility,
 211 sexual functioning, diabetes control and reduced social burden. Furthermore, we found
 212 vigorous-intensity activities were negatively associated with anxiety and worry. In other words,
 213 vigorous-intensity activities were associated with lower anxiety and worry. The results of this
 214 study further underscore the importance of physical activity in the management of type 2
 215 diabetes.

216 The findings that walking was associated with better energy and mobility, sexual functioning,
217 diabetes control and reduced social burden, and vigorous activities were associated with less
218 anxiety and worry are comparable to the findings of studies investigating whether there were
219 relationships between physical activity, diabetic control and quality in persons with type 2
220 diabetes [15, 23]. Colak et al.,[15] in their study found that physical activity was associated with
221 better energy and mobility, sexual functioning, diabetes control and reduced social burden and
222 anxiety and worry. Similarly, Osei-Yeboah et al.,[23] in their study, reported that physical activity
223 was associated with glycaemic control.

224 The lack of significant associations between sitting and quality of life found in this study was
225 similar to that found in the study by Colak et al.[15] investigating the association between
226 physical activity and quality of life in persons with type 2 diabetes but contrary to the study by
227 Daniele et al. [25] that examined associations between physical activity, comorbidity severity,
228 depressive symptoms, and health-related quality of life in persons with type 2 diabetes and
229 found sedentary lifestyle was associated with low quality of life, functional capacity and general
230 health.

231 The descriptive statistic indicated that the study sample reported poor quality of life, high sitting
232 time, low walking, moderate-intensity and vigorous-intensity activities which were comparable
233 to those reported in similar studies investigating activity patterns and quality of life in persons
234 with type 2 diabetes in Turkey and Brazil [15, 25]. Furthermore, the levels of moderate-intensity
235 activities and vigorous-intensity activities found in this study were less than the recommended
236 minimum for each category (600 MET-min/week for moderate-intensity activities, and 3,000
237 MET-min/week for vigorous-intensity activities) [26]. Previous works on physical activity pattern
238 among persons with type 2 diabetes in Ghana concluded that the level of physical activity in this
239 population was inadequate [23].

240 Taken together, the findings of poor overall quality of life, high sitting time and low physical
241 activity level highlights the fact that persons with type 2 diabetes spends considerable amount

242 of time in sedentary and do not engage in adequate amount of physical activity. Time spent in
243 sedentary has been shown to be strongly and adversely associated with poor cardio-metabolic
244 health and poor general health [27]. Given that physical inactivity is detrimental and physical
245 activity plays an important role in the management of type 2 diabetes, reducing sitting time and
246 increasing physical activity is essential in persons with type 2 diabetes. Consequently, there is
247 the need to explore ways to improve physical activity participation and quality of life in this
248 population [28].

249 Guidance on engagement in optimal physical activity behavior may be beneficial for persons
250 with type 2 diabetes. Conversely, walking, a form of physical activity that is classified as
251 economical and has a low risk [29] may be easier and more realistic and achievable for persons
252 with type 2 diabetes to engage in, compared to vigorous forms of physical activity. The study
253 findings that walking was associated with improved quality of life thus suggest that persons with
254 diabetes may benefit from interventions incorporating walking. This highlights the need for the
255 development and design of goal-directed interventions incorporating walking in relation to what
256 we know from literature to help guide treatment efforts for people with type 2 diabetes.

257 This study had a number of limitations. Importantly, because a convenience sampling strategy
258 was used, the findings are limited in their generalizability to a more diverse type 2 diabetes
259 population. In addition, the relatively small study sample size limits the evaluation of confounding
260 effects (adjusted estimates), thus limit the ability to draw firm conclusion. It would be useful to
261 replicate these analyses in a larger sample to obtain adjusted estimates while controlling for
262 confounders such as disease duration, age, gender and comorbidity. Furthermore, although
263 self-report measures are more feasible in population studies, they are susceptible to biases as
264 they involve recalling activities (over days, weeks, or months) that could lead to underreporting
265 or overreporting [30], thus the use of self-report measures in this study is a limitation. Using an
266 objective device would allow to examine more macro levels of activity and is warranted in future
267 study. Lastly, the study design employed limits the ability to draw causal inferences.

268 **Conclusion**

269 In this study we examined associations between self-reported activity patterns and quality of life
270 domains and found that physical activity, particularly walking and vigorous-intensity activities
271 were associated with better quality of life. The result of the study further showed that persons
272 with type 2 diabetes exhibited high sedentary lifestyle and low engagement in health-related
273 physical activity. Taken together, the finding underscore the importance of physical activity in
274 the management of type 2 diabetes and the overall health of persons with type 2 diabetes, and
275 provides a platform for further research into tailored physical activity interventions incorporating
276 walking for this population. Such physical activity interventions would help better manage type
277 2 diabetes, improve the quality of life of persons with type 2 diabetes and consequently reduce
278 the burden of type 2 diabetes.

279 **Acknowledgement**

280 The authors thank the study participants and staff of the Diabetes Clinic, Ho Teaching Hospital,
281 Ho, Ghana.

282 **Funding**

283 This research did not receive any specific grant from funding agencies in the public, commercial,
284 or not-for-profit sectors.

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