Patterns and demographic correlates of domain-specific physical activities and their associations with dyslipidaemia in China: a multiethnic cohort study

Lunwei Du,1 Peng Hong,1 Peng Luo,1 Ziyun Wang,1 Qibing Zeng,1 Han Guan,1 Haiyan Liu,1 Zhiping Yuan,2 Degan Xu,3 Fang Nie,1 Junhua Wang1

ABSTRACT

Objective To evaluate the patterns and demographic correlates of domain-specific physical activities (PAs) and their associations with dyslipidaemia among ethnic minorities in China.

Design Cross-sectional.

Participants In total, 17081 individuals were included.

Primary and secondary outcome measures Domain-specific PAs were assessed using a questionnaire related to occupational, transportation, housework and leisure-time PAs. Dyslipidaemia was measured using an automatic biochemical instrument. Demographic variables were self-reported.

Results Housework accounted for most PAs in the study. Elderly people were more likely to participate in housework and leisure-time PA, whereas the mean level of PA in people with low education level and household income was high. With G3–G4 levels of occupational PA, Dong men (G4: OR=0.530, 95% CI 0.349 to 0.806), Miao women (G3: OR=0.698, 95% CI 0.524 to 0.931; G4: OR=0.611, 95% CI 0.439 to 0.850) and Bouyei women (G3: OR=0.745, 95% CI 0.566 to 0.981; G4: OR=0.615, 95% CI 0.440 to 0.860) tended to have a low risk of dyslipidaemia. With G2 levels of transportation PA, PA could reduce the risk of dyslipidaemia in Bouyei women (G2: OR=0.747, 95% CI 0.580 to 0.962), G2–G3 levels of leisure-time PA could reduce the risk of dyslipidaemia in Miao men (G2: OR=0.645, 95% CI 0.446 to 0.933; G3: OR=0.700, 95% CI 0.513 to 0.954). However, a high risk of dyslipidaemia was observed with G4 levels of leisure-time PA among Bouyei women (G4: OR=0.353, 95% CI 1.001 to 1.905) and with transportation PA among Dong men (G4: OR=1.591, 95% CI 1.130 to 2.240).

Conclusion The main PA of the ethnic minorities in Guizhou Province involved housework. Domain-specific PAs varied with demographic factors, and active domain-specific PAs were associated with a reduced risk of dyslipidaemia.

INTRODUCTION

Dyslipidaemia is the major risk factor for cardiovascular diseases (CVDs) and is characterised by increased levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and triglyceride (TG) and/or a decreased level of high-density lipoprotein cholesterol (HDL-C). According to the survey of a chronic kidney disease study and the nutrition and chronic diseases of Chinese residents (2015), the prevalence of dyslipidaemia in Chinese adults increased from 18.6% to 40.4% from 2002 to 2012, which is closely related to the improvement in living standards and lifestyle changes.

Physical activity (PA) is a vital component of the therapeutic lifestyle recommendations for prevention and treatment of dyslipidaemia in adults. Domain-specific PAs include occupational, transportation, housework and leisure-time PAs. Generally, occupational PA accounts for most of the PA of individuals, and its impact on health should not be underestimated. Bennett et al divided PA into occupational-related and non-occupational-related PAs to explore the relationship between the PA and CVD risk; the author observed that the high occupational PA levels were associated with a considerable reduction in CVD risk. The China Kadoorie Biobank (CKB) study assessed the association between transportation PA and CVD in a large-scale chronic disease cohort. The study reported that in Chinese cities, cycling is mainly related to the risk of ischaemic heart disease.
and ischaemic stroke, and walking is associated with a low risk of ischaemic heart disease. Only a few studies are available regarding the health effects of housework PA, and large-scale epidemiological studies comparing the association between domain-specific PA and dyslipidaemia in China are unavailable to date. In addition, less attention has been paid to the demographic correlates of domain-specific PAs. Domain-specific PAs might vary due to differences in sociodemographic characteristics. Studies have explored demographic correlates of total and domain-specific PAs. However, because of differences in cultural and historical backgrounds of participants across these studies, it remains unclear whether the demographic correlates of domain-specific PAs vary because of ethnic and cultural differences.

Guizhou Province belongs to the plateau and mountainous region of Southwest China. In this province, ethnic minorities live in concentrated communities. Most of these communities are Miao, Bouyei and Dong, accounting for approximately 74.56% of the total number of ethnic minorities in the province. Owing to the geographical environment and economic conditions in Guizhou Province, the main PAs of ethnic minorities and the impact of domain-specific PAs on their health may differ from those of people in other regions of China and abroad. Currently, some studies have reported the relationship between PA and dyslipidaemia in other regions of China, and the evidence is relatively sufficient. However, little attention has been paid to Chinese ethnic minorities, and relevant evidence on the practice of dyslipidaemia prevention and management is still lacking.

Therefore, we performed a cross-sectional investigation by using data from the China Multi-Ethnic Cohort (CMEC) study. The objectives of this study were (1) to determine the demographic correlates of PA from occupation, transportation, housework and leisure-time; and (2) to examine the associations of domain-specific PAs with dyslipidaemia in men and women of Dong, Miao and Bouyei communities in Southwest China.

MATERIALS AND METHODS

Study populations

Relevant data were obtained from the CMEC study. Detailed information on the CMEC study design, background, sampling methods and respondents is described in a previous study. Briefly, all permanent residents aged 30–79 years were recruited between May 2018 and September 2019 from Congjiang, Leishan and Liping counties of Qiandongnan Miao and Dong Autonomous Prefecture and Guiding, as well as Libo and Dushan counties of Qiannan Miao and Bouyei Autonomous Prefecture, Guizhou Province, Southwest China. We excluded 1709 participants for various reasons (figure 1).

Physical activity

Participants self-reported their usual type and duration of activities related to occupational, transportation, housework and leisure-time PAs during the past year. Two sets of occupation-related and transportation-related questions were used; one set was for farmers and the other set was for non-farmers. For non-farmers, the question related to occupational PA was ‘Did you mainly sit or stand or do physical work when you go to work?’ For farmers, the corresponding question was regarding PAs related to agricultural production and those involving other jobs apart from agricultural work. Transportation PA was defined as the PA involved between home and workplace. Housework PA included activities related to all types of housework (including taking care of children). Leisure-time PA included the time spent on exercise (eg, t’ai chi, fast walking, long-distance running and swimming).

To quantify the amount of PA, metabolic equivalent tasks (METs) from the 2011 update of a major compendium of PAs were used. The MET value for a particular type of PA represents the ratio of energy consumed per kilogram of body weight per hour to the energy consumed during sitting. Thus, 1 MET is equivalent to sitting quietly for 1 hour. The MET value for domain-specific PAs was obtained from a previous study. The domain-specific PAs were assessed by multiplying the number of hours spent per day on a particular activity with the MET score for that activity.

Dyslipidaemia

All blood samples were collected in the >8 hour fasting state. Baseline concentrations of TC, HDL-C, TG and LDL-C were measured using an automatic biochemical instrument (model 7180; Hitachi, Japan). According to the Guideline for Prevention and Treatment of
Dyslipidemia in Chinese V.2016, dyslipidemia was defined as an abnormality in any of the four indicators of blood lipids (TC ≥6.22 mmol/L, TG ≥2.26 mmol/L, LDL-C ≥4.14 mmol/L, or HDL-C <1.04 mmol/L).

**Statistical analyses**

All analyses were based on stratification according to sex and ethnicity. Domain-specific PAs were categorised into four groups (G1: PA=0, G2: 0<PA≤p25, G3: p25<PA≤p75, and G4: PA>p75 MET-hours/day) based on quartiles among 17 081 participants. Categorical variables between sexes were compared using χ² test, and continuous variables between sexes were compared using independent sample t-test. For individuals who had no PA (PA=0) in specific fields, the classification variables are described as percentage, and the continuous variables are expressed as mean (±SD). Logistic regression models (for those who had no PA in specific fields) and multiple linear regression models (for those who had some activities in specific fields) were used to evaluate the association between social demographic characteristics and domain-specific PAs.

To explore the relationship between domain-specific PAs and dyslipidaemia, we divided the population into six groups (Dong men, Miao men, Bouyei men, Dong women, Miao women and Bouyei women) according to stratification based on ethnicity and sex. The adjusted ORs and 95% CIs for dyslipidaemia associated with domain-specific PA levels were estimated using binary logistic regression models. The possible confounding factors were identified using directed acyclic graph (DAG). The DAG was drawn by referring to the literature on factors affecting PA and dyslipidaemia and using DAGitty. After the drawing was completed, the variables that needed to be adjusted were automatically generated in the upper right corner. As shown in figure 2, the exposure variable was PA, and the outcome variable was dyslipidaemia. The influencing factors included were sex, ethnicity, occupation and family history. The minimal sufficient adjustment sets for estimating the direct effect of PA on dyslipidaemia comprised factors such as sex; ethnicity; age (30–39, 40–49, 50–59, 60–69 and 70–79 years); education (no formal school, primary school, middle school, high school, and college or university); annual household income (<12 000, 12 000–19 999, 20 000–59 999, 60 000–99 999 and ≥100 000 yuan); occupation (farmer, factory worker, sales and others, professionals, and retired and others); and BMI (thin: BMI <18.5 kg/m², normal: 18.5≤BMI<24.0 kg/m², overweight: 24.0≤BMI<28.0 kg/m², obese: BMI ≥28.0 kg/m²), BMI, body mass index.

**RESULTS**

Patients and the public were not involved in the study.

**Figure 2** Possible confounding factors adjusted using directed acyclic graph were sex; ethnicity; age (30–39, 40–49, 50–59, 60–69 and 70–79 years); education (no formal school, primary school, middle school, high school, and college or university); annual household income (<12 000, 12 000–19 999, 20 000–59 999, 60 000–99 999 and ≥100 000 yuan); occupation (farmer, factory worker, sales and others, professionals, and retired and others); and BMI (thin: BMI <18.5 kg/m², normal: 18.5≤BMI<24.0 kg/m², overweight: 24.0≤BMI<28.0 kg/m², obese: BMI ≥28.0 kg/m²), BMI, body mass index.

The mean baseline age of the 17 081 participants was 52.4 years, and 66.0% of the participants were women (29.4% from the Miao community, 38.5% from the Dong community and 32.1% from the Bouyei community). Housework PA was the largest domain in four major areas. A total of 11 057 (98.1%) women and 4932 (84.8%) of men engaged in housework PA (p<0.001). Overall, the mean levels of TG, TC, LDL-C and HDL-C at baseline were 1.8, 4.9, 2.8 and 1.5 mmol/L. Men had higher TG levels (2.2 mmol/L vs 1.7 mmol/L) and lower HDL-C levels (1.4 mmol/L vs 1.5 mmol/L) than women; however, the levels of TC and LDL-C were similar between men and women (all p<0.05) (table 1). As shown in table 2, dyslipidaemia was more likely to be present in men than in women (35.7% vs 25.1%, p<0.001), especially in those belonging to the Dong and Miao communities (all p<0.001) (table 2).

Age was inversely associated with the proportion of having occupational PA and the mean levels of occupational PA in both sexes (all p<0.05). The proportion of non-working people increased dramatically within the 60–69 year age group in men (from 13.0% to 36.1% in the...
Table 1  Main characteristics of the study participants

| Characteristics | Men (n=5814) | Women (n=11 267) | Total (N=17 081) | P value |
|-----------------|--------------|-------------------|------------------|---------|
| Age (years), n (%) |
| 30–39           | 668 (11.5)   | 1587 (14.1)       | 2255 (13.2)      | <0.001  |
| 40–49           | 1511 (26.0)  | 3396 (30.1)       | 4907 (28.7)      |         |
| 50–59           | 1690 (29.1)  | 3573 (31.7)       | 5263 (30.8)      |         |
| 60–69           | 1302 (22.4)  | 1935 (17.2)       | 3237 (19.0)      |         |
| ≥70             | 643 (11.1)   | 776 (6.9)         | 1419 (8.3)       |         |
| Mean (SD)       | 53.9 (11.6)  | 51.6 (10.9)       | 52.4 (11.2)      | <0.001  |
| Ethnicity, n (%) |
| Miao            | 1845 (31.7)  | 3178 (28.2)       | 5023 (29.4)      | <0.001  |
| Dong            | 2319 (39.9)  | 4263 (37.8)       | 6582 (38.5)      |         |
| Bouyei          | 1650 (28.4)  | 3826 (34.0)       | 5476 (32.1)      |         |
| Occupational PA*† (MET-hours/day), n (%) | <0.001 |
| G1              | 1166 (20.1)  | 3350 (29.7)       | 4516 (26.4)      |         |
| G2              | 1106 (19.0)  | 2084 (18.5)       | 3190 (18.7)      |         |
| G3              | 2157 (37.1)  | 4130 (36.7)       | 6287 (36.8)      |         |
| G4              | 1385 (23.8)  | 1703 (15.1)       | 3088 (18.1)      |         |
| Transportation PA*‡ (MET-hours/day), n (%) | <0.001 |
| G1              | 1529 (26.3)  | 4081 (36.2)       | 5610 (32.8)      |         |
| G2              | 1482 (25.5)  | 2309 (20.5)       | 3791 (22.2)      |         |
| G3              | 2029 (34.9)  | 3572 (31.7)       | 5601 (32.8)      |         |
| G4              | 774 (13.3)   | 1305 (11.6)       | 2079 (12.2)      |         |
| Housework PA*§ (MET-hours/day), n (%) | <0.001 |
| G1              | 882 (15.2)   | 210 (1.9)         | 1092 (6.4)       |         |
| G2              | 2791 (48.0)  | 2938 (26.1)       | 5729 (33.5)      |         |
| G3              | 1760 (30.3)  | 5448 (48.4)       | 7208 (42.2)      |         |
| G4              | 381 (6.6)    | 2671 (23.7)       | 3052 (17.9)      |         |
| Leisure-time PA*¶ (MET-hours/day), n (%) | <0.001 |
| G1              | 4265 (73.4)  | 8354 (74.1)       | 12 619 (73.9)    |         |
| G2              | 454 (7.8)    | 682 (6.1)         | 1136 (6.7)       |         |
| G3              | 811 (13.9)   | 1628 (14.4)       | 2439 (14.3)      |         |
| G4              | 284 (4.9)    | 603 (5.4)         | 887 (5.2)        |         |
| Lipid Index (P25, P75), mean (SD) |
| TG (mmol/L)     | 2.2 (2.2)    | 1.7 (1.3)         | 1.8 (1.7)        | <0.001  |
| TC (mmol/L)     | 4.9 (1.0)    | 4.9 (0.9)         | 4.9 (0.9)        | 0.010   |
| LDL-C (mmol/L)  | 2.8 (0.9)    | 2.8 (0.8)         | 2.8 (0.8)        | 0.030   |
| HDL-C (mmol/L)  | 1.4 (0.4)    | 1.5 (0.3)         | 1.5 (0.3)        | <0.001  |

P value refers to the significance of difference between men and women.

*Self-reported, mean (SD): mean±SD, PA (MET-hours/day).
†G1 means PA=0; G2 means 0<PA≤10.8; G3 means 10.8<PA≤30.4; G4 means PA>30.4.
‡G1 means PA=0; G2 means 0<PA≤1.3; G3 means 1.3<PA≤4.0; G4 means PA>4.0.
§G1 means PA=0; G2 means 0<PA≤2.8; G3 means 2.8<PA≤8.4; G4 means PA>8.4.
¶G1 means PA=0; G2 means 0<PA≤2.3; G3 means 2.3<PA≤6.6; G4 means PA>6.6.
HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; MET, metabolic equivalent task; PA, physical activity; TC, total cholesterol; TG, triglyceride.

50–59 year age group) and the 50–59 year age group in women (from 15.5% to 30.8% within the 40–49 year age group). Among those who were still working, the mean levels of occupational PA greatly declined (all p<0.05). In leisure-time PA, an opposite trend was observed. The mean exercise level of the 60–69 year age group was the
highest compared with other age groups in both sexes (all p<0.05). Among men, Dong participants had higher mean levels of transportation and housework PAs but lower mean levels of occupational and leisure-time PAs than the Miao and Bouyei participants (all p<0.05). Similar results were observed among women (all p<0.05). The mean level of leisure-time PA was the lowest, particularly among Bouyei women (online supplemental table S1).

The proportion of non-working people was found to be low among the participants with college or university education. A high education level was associated with low mean levels of occupational, transportation and housework PAs (all p<0.05). Similar results were observed in case of household income (all p<0.05). Factory workers had the highest mean level of occupational PA (33.0 and 26.8 MET-hours/day for men and women, respectively), followed by farmers (25.3 and 21.9 MET-hours/day for men and women, respectively). Farmers had the highest mean level of transportation PA (4.0 and 4.2 MET-hours/day for men and women, respectively). Retired and other people, particularly women, had the highest mean levels of housework PA (5.4 and 10.1 MET-hours/day for men and women, respectively) and leisure-time PA (5.5 and 5.1 MET-hours/day for men and women, respectively) (all p<0.05) (online supplemental table S1).

We analysed the association of dyslipidaemia with domain-specific PAs of unadjusted variables and some adjusted variables (namely, sex, ethnicity, occupation, education, annual household income, BMI and age) (see additional file, online supplemental figures S1–S3). However, we mainly describe and discuss the results of adjusted all variables. As shown in figure 3, G3−G4 levels of occupational PA significantly reduced the risk of dyslipidaemia (p<0.05), and G4 levels of transportation PA increased the risk of dyslipidaemia in the general population (p<0.05). In figure 4, Dong men and Bouyei and Miao women with G3−G4 levels of occupational PA had significantly reduced risk of dyslipidaemia (all p<0.05). Bouyei women with G2 levels of transportation PA also exhibited a significantly reduced risk of dyslipidaemia (p<0.05). Additionally, the risk of dyslipidaemia

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**Table 2** Sex and ethnicity characteristics with or without dyslipidaemia

| Characteristics | Dyslipidaemia (n=4905) | Non-dyslipidaemia (n=12 176) | P value |
|-----------------|------------------------|-----------------------------|---------|
| Sex, n (%)      |                        |                             |         |
| Men             | 2077 (35.7)            | 3737 (64.3)                 | <0.001  |
| Women           | 2828 (25.1)            | 8439 (74.9)                 |         |
| Ethnicity, n (%)|                        |                             | <0.001  |
| Dong            | 2032 (30.9)            | 4550 (69.1)                 |         |
| Miao            | 1516 (30.2)            | 3507 (69.8)                 |         |
| Bouyei          | 1357 (24.8)            | 4119 (75.2)                 |         |
| Combination of sex and ethnicity, n (%) |         |                             | <0.001  |
| Dong men        | 837 (36.1)             | 1482 (63.9)                 |         |
| Miao men        | 696 (37.7)             | 1149 (62.3)                 |         |
| Bouyei men      | 544 (33.0)             | 1106 (67.0)                 |         |
| Dong women      | 1195 (28.0)            | 3068 (72.0)                 |         |
| Miao women      | 820 (25.8)             | 2358 (74.2)                 |         |
| Bouyei women    | 813 (21.2)             | 3013 (78.8)                 |         |
was significantly lower in Miao men with G2–G3 levels of leisure-time PA. However, Bouyei women with G4 levels of leisure-time PA and Dong men with G4 levels of transportation PA demonstrated an increased risk of dyslipidaemia (p<0.05). The association between housework PA and dyslipidaemia was not found to be significant (all p>0.05, figure 4).

DISCUSSION

The present study explored the patterns and demographic correlates of domain-specific PAs and their associations with dyslipidaemia. Our main findings are as follows:

1. Unlike that of other study populations,17–19 the PA of Miao, Dong and Bouyei people, particularly women, aged 30–79 years in Guizhou Province was mainly housework. This difference can be attributed to the presence of differences in social division of labour in Chinese women and men. Women do more housework than men, and housework is the duty of women; this belief has been deeply rooted in the hearts of the public.

2. Domain-specific PAs varied as per demographic factors, and high levels of PAs were associated with a low risk of dyslipidaemia. By analysing the incidence of dyslipidaemia across different sexes and ethnic groups, we found that the prevalence of dyslipidaemia was the highest in the Dong and Miao populations, particularly among men of this community. The prevalence of dyslipidaemia was lowest in the Miao population. The difference in prevalence might be related to the eating habits of various ethnic groups. The Dong population consumes four meals a day, two of which are tea (Camellia oleifera). Studies have shown that drinking C. oleifera while eating fried foods and fried peanuts might be associated with an increased risk of dyslipidaemia.20 21 The diet of the Miao population is acidic and spicy, which has an impact on blood lipids to a certain extent.21 There are many differences between men and women in physiology, and the diet intake in men is generally higher than that in women. This may be one of the reasons that dyslipidaemia predominantly occurs in men.

Our study confirms the findings8 22–24 related to demographic correlates of domain-specific PAs reported in studies in the following aspects. Older men participants, particularly those who had retired, had a low level of occupational PA but high levels of housework and active leisure-time PAs, probably because of the availability of more time for such activities. Additionally, this study indicated that the participation rate of adults with leisure-time PA in minority regions was much lower than that in Western countries25 26 but slightly higher than that reported in the CKB study and China National Nutrition and Health Survey.27 28 This difference might be attributed partly to specific festivals of ethnic minorities; all ethnic groups combine their own wisdom and unique local culture to create highly abundant sports activities, such as the Lusheng dance of the Miao ethnic group, wrestling of the Dong ethnic group, and the dragon and lantern dances of the Bouyei ethnic group.29

Factors such as the education level and annual household income exhibited positive influences on leisure-time PA. The participants with high education level and high annual household income had high leisure-time PA, and the finding is consistent with those of some previous studies.8 22 24 Leisure-time PA has been reported to be beneficial for people’s health, suggesting that more attention should be paid to individuals with low education and annual household income. In this study, male and female factory workers had the highest occupational PA level and
the lowest leisure-time PA level. Excessive occupational PA level might cause occupational stress, and leisure-time PA could alleviate this stress. Therefore, people with high occupational PA should strengthen PA exercise in their spare time.

Results of the studies on the association between PA and dyslipidaemia have been inconsistent. For example, some studies have reported that PA is not associated with dyslipidaemia, whereas other studies have reported an association between these aspects. However, the results of these studies were based only on the metabolic equivalent of total PA, and only a few reports are available on the relationship between domain-specific PAs and dyslipidaemia among minorities. A key finding of this study is the variations in the association between domain-specific PAs and dyslipidaemia according to sex and ethnicity. A study by Kokkinos and Fernhall reported that the change in dyslipidaemia induced by exercise might be related to sex. Men and women often engage in different fields and intensities of PAs. Among Dong men and Bouyei and Miao women, G3–G4 levels of occupational PA could reduce the risk of dyslipidaemia, indicating that the average occupational PA level of Dong men and Miao and Bouyei women was approximately 22 MET-hours/day. We speculate that this may be related to the fact that occupational PA at G3–G4 levels can reduce the risk of dyslipidaemia. G2 levels of transportation PA could reduce the risk of dyslipidaemia in Bouyei women, whereas the G4 level of transportation PA increased the risk of dyslipidaemia in Dong men. G2–G3 levels of leisure-time PA could reduce the risk of dyslipidaemia in Miao men. From online supplemental table S1, we can infer that the mean level of transportation PA among Bouyei women was lower than that among women from other ethnicities, whereas the mean level of transportation PA among Dong men was higher than that among men from other ethnicities. The mean level of leisure-time PA among Miao men was higher than that among men from other ethnicities. Therefore, we speculate that the low level of transportation PA among Bouyei women and Dong men and the high level of leisure-time PA among Miao men might have reduced the risk of dyslipidaemia in these populations; however, more evidence is required to confirm this assumption. Dyslipidaemia is a risk factor for coronary heart disease, aortic stenosis and CVDs. PA may reduce the risk of these diseases, especially atherosclerosis, by changing the transport of lipid oxidation products.

In the baseline survey, we found that the mean level of leisure-time PA among Bouyei women was significantly lower than that among other ethnicities. An unexpected finding of our study is that the Bouyei women with G4 levels of leisure-time PA had a high dyslipidaemia risk, which contradicts the findings of other studies. Thus, we infer that leisure-time PA in this group did not reach a certain dose, and hence, it could not produce beneficial effects on dyslipidaemia. In future research, we aim to explore the dose–response relationship between domain-specific PAs and dyslipidaemia and to clarify the optimal dose to provide more constructive information for the prevention of dyslipidaemia in minorities. Descriptive research was limited to determining the temporal order of causality. Moreover, we speculate that the accessibility of stadiums and equipment and the lack of understanding of the importance of amateur exercise also play a role in influencing individuals to participate in leisure-time PA. Finally, no relationship was observed between housework PA and dyslipidaemia among the studied ethnic groups. A possible explanation for this finding is that the housework PA is intermittent and not intensive. Additionally, the impact of housework PAs on health was replaced by PAs in other fields. In addition, the questions related to housework PA in this study were relatively limited, which might have led to the consistent answers by the included ethnic groups. Further studies should include more contents related to housework PA to clarify the impact of housework PA on health.

We assume that this study would have a positive impact on the management of local dyslipidaemia. Exercise can improve metabolism and promote physical and mental health. Dyslipidaemia may be prevented through interventions aimed at promoting PA. Hence, population-wide education for active PAs should be provided to individuals. Considering the ongoing physical inactivity and dyslipidaemia epidemics that are affecting the contemporary society, understanding the patterns and demographic correlates of domain-specific PAs and their associations with dyslipidaemia is of great importance for promoting public health. We found that the three ethnic groups in Guizhou Province had their own unique PA patterns, such as insufficient leisure-time PA, and this deficiency might lead to the occurrence of dyslipidaemia. Therefore, we recommend that when it is difficult to change PA in other fields, primary health service institutions should promote leisure-time PA through health education and prevent dyslipidaemia from causing greater economic expenditure.

This study had several advantages. First, to the best of our knowledge, this study is the first large-scale epidemiological study conducted by a Chinese group on ethnic minorities in Southwest China, and a suitable electronic questionnaire was used to investigate domain-specific PAs. The study could effectively reveal the PA characteristics of the local population and preliminarily explored the relationship of PA with dyslipidaemia to provide ideas for further research. Second, our research considered PA in four major areas, which might provide valuable information. Third, this study received strong support from governments at all levels, Centers for Disease Control and Prevention, and local clinics. Therefore, relevant resources, on-site investigation and public co-operation could be ensured to improve the quality of data and to minimise the loss of survey participants during follow-up. This study also has some limitations. First, PA was self-reported in our study. Second, because of the cross-sectional study design, causal inference was limited and
could only provide clues about aetiology, which necessitates further follow-up studies. Third, we included only participants aged 30–79 years; thus, we may have missed information on early life exposures that might have an impact on the PA level. Additionally, most of the participants were women. Nevertheless, our study might be the first in Southwest China to link PA with dyslipidaemia, which highlights the significance of this study in improving public health.

CONCLUSION
Our study revealed that housework accounts for the majority of PA among the ethnic minorities in Guizhou Province. Domain-specific PAs varied according to the demographic factors, and active domain-specific PAs were associated with a reduced risk of dyslipidaemia. Moreover, this study indicated that the level of leisure-time PA among Bouyei women might be insufficient, and more attention should be paid to the health status of this population. Finally, our study suggested that the impact of PA on health is not limited to only a single field discussed in this study and should be considered comprehensively, rather than considering a single aspect or simply combining some aspects, in future research to obtain more useful information.

Contributors LD and JW substantially contributed to the design and drafting of the study and the analysis and interpretation of the data. LD wrote the manuscript. PL, FH, OZ, FN, ZY, DX, HG, HL and ZW revised the manuscript critically for important intellectual content. All authors were involved in the collection of data and approval of the final version of the manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Sichuan University Medical Ethical Review Board (K2016038) and the ethics committee of the Affiliated Hospital of Guizhou Medical University (2018094). The informed consent form was read and signed by participants before this study. Participants gave informed consent to participate in the study before taking part.

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ORCID id Junhua Wang http://orcid.org/0000-0003-3180-539X

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